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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. MARCH 22, 1900. CHICAGO, ILL. NUMBER 12

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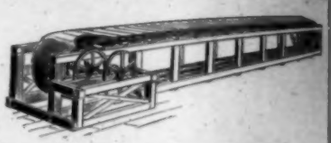

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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. MARCH 22, 1900. CHICAGO, ILL. NUMBER 12

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

On the threshold of the active season the iron trade is still devoid of significant features. In the Central West, from which branch the main arteries of the Bessemer steel industry, evidences continue of the strain upon every factor in the line beginning with Bessemer iron. Steel works are pressing for the iron due them and the limitation upon output is gauged by the performance of the blast furnaces rather than by the conditions in finishing lines. The tonnage of finished product would be greater if the supply of Bessemer pig iron could be increased. This is the key to surprisingly well sustained prices of Bessemer steel and Bessemer pig iron. It would appear that months will elapse before any considerable addition can be made to the output of Bessemer iron, and meantime the chances are in the other direction, because of the number of furnaces that must shortly go out for repairs, many cases being known in which managers regard each month's output as so much more than was to be reckoned on from the old lining. There are some indications as each week's transactions in Bessemer iron are reported, that more iron has been sold for delivery in the first half than will come from the furnaces in that time. The situation in foundry iron is not perceptibly altered. The opinion has been expressed by close observers that foundry yard stocks have been depleted since Jan. 1 to an extent equal to the gain in stocks at furnaces. But higher grades have been used up and the accumulation at furnaces are of lower grades. Nothing like a buying movement among the foundries is visible yet. The volume of inquiries much exceeds the rate of buying. The concessions made do not stimulate buying, but rather limit it, the bulk of the intended purchase being postponed. Hesitation will be more marked, possibly, in view of the failure of the attempt to settle the machinists' strike. At present the outlook is ominous, the struggle settling into a test of endurance. On the other hand possibilties of trouble were avoided in the stove trade conference with the molders, and in that of the Lake Erie dock managers and 'longshoremen. Advances to thousand of workmen resulted, which with the recent advances to puddlers and rolling mill finishers, to wrought pipe and tube workers, to Pennsylvania miners and coke workers and to the Lake Superior iron miners, mean an increase in the purchasing power of 100,000 to 150,000 men directly dependent on the iron trade. In general, finished material has been at low point the past week, apart from the forms controlled by agreement. In plate, 2c has been shaded, and yet certain mills are maintaining 2.10c to 2.15c. Bar iron prices are cut in Pennsylvania, but in the Central Western districts the leading producer maintains 2.15c, at mill. There is some indication that in steel bars the recent agreed price of 2.25c, Pittsburg, is not fully kept. The outlook for spring work in bridge and building lines and for continued large consumption of wire products is excellent. Foreign pig iron markets are stronger. Middlesboro warrants went up 3s last week to $17.75, an advance of about $1 a ton since March 1. Stocks of iron in Great Britain were but 436,000 tons on March 1, a decrease of 91,000 tons since Jan. 1. It is only in recent years that 1,500,000 to 2,000,000 tons was regularly carried. Furnaces in the United States continue to receive inquiries from the other side, and if the iron can be spared there will be no difficulty in doing business at no great concession from today's prices.

PITTSBURG.

OFFICE OF *The Iron Trade Review*, 1125-1126 PARK BUILDING, March 21.

Sales of Bessemer pig iron continue, and during the past week 14,000 tons were sold for delivery during June and July, at the association price of $24, valley. The few furnaces outside of the association are advancing their prices and those that quoted $24 60, Pittsburg, several weeks ago are now holding out for $24.90 and $25. One small sale of Bessemer of 300 tons for immediate delivery, is reported to have been made at $25 25, Pittsburg. It is further reported that one seller has offered 5,000 tons of Bessemer at $24.75 Pittsburg, but this furnace is outside of the association. On the whole the Bessemer market is growing stronger instead of weaker, and with nearly all the furnaces sold up for the first half, there is at present no weaker market in sight.

The National Tube Co. was awarded a government contract this week for 70,000 tubes for installation in the new cruisers that will compose the Asiatic squadron. The tubes are to be of the seamless type, the standard adopted by the government engineers some time ago. The estimated cost is about $225,000. All the sheet mills that have given options on their plants to the promoters of the proposed consolidation were closed down Saturday night for one week, according to agreement, for the purpose of taking inventory. It is now authoritatively stated that at a meeting to be held in New York City next week, the sheet consolidation will be perfected and officers and directors elected.

PIG IRON.—While the demand for Bessemer pig iron continues very brisk, the sales of foundry iron in this district have probably not aggregated 500 tons during the past week. The foundrymen are still prone to wait for a weaker market, although they are making numerous inquiries. Forge has been in little demand during the week and only a few small sales were made. We quote as follows:

Bessemer, valley furnace	$24.00		
Bessemer, Pittsburg	24 90		
No. 1 Foundry	$23.25	to	23.75
No. 2 Foundry	22.50	to	23.00
No. 3 Foundry	21.75	to	22.25
Gray Forge, valley furnace	21.00	to	21.25
Gray Forge, Pittsburg	21.00	to	21.25

STEEL.—With the extraordinary firmness on Bessemer pig iron, the steel market holds at the prevailing quotations. There are no large orders worthy of note being placed. The large mills are running on standing contracts, while the smaller consumers are only making purchases for immediate consumption in anticipation of a slump. We continue to quote 4x4 billets at $35 and small billets at $36, mill, Pittsburg, Wheeling or valley. Sheet bars remain quiet but firm and we continue to quote $36, at mill. As soon as the sheet mill consolidation is perfected, some large sales of sheet bars are expected.

FERRO-MANGANESE.—The quotation of $125 for domestic 80 per cent is unchanged.

RAILS AND TRACK MATERIAL.—Brisk inquiry for track material continues, and during the week a number of small orders were placed at prevailing quotations. Rails remain quiet, the mills working on orders placed several months ago. Our quotations are unchanged as follows: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—spikes, 2.50c; track bolts, square nuts, 3.60c; hexagon nuts, 3.60c to 3.85c; splice bars, 2.50c to 2.60c; links and pins, 3c to 3.10c.

SPELTER.—The market has been easire during the past week

and we quote 4.55c to 4.60c, Pittsburg, for prime Western grdes.

SKELP.—There is little doing in skelp, only small sales having been reported during the past ten days. We quote grooved iron from 2c to 2.10c and grooved steel at about the same fig ure. Sheared iron is held at 2.25c to 2.35c and sheared steel 2.20c to 2.25c.

MUCK BARS.—A sale of 1000 tons of muck bar at $32.90, Pittsburg, is reported. While the demand is not very strong, the market remains firm, and we quote $32.50 to $33 for standard grades. These prices are shaded for scrap muck.

BARS.—There is little demand for bars in this district at the present time, at the recent agreed quotations. The Eastern mills that recently invaded territory tributary to Pittsburg are still taking business. Though there are rumors of shaded prices on steel, we continue the quotation of 2.25c in large lots, and 2.35c for small lots. Common iron bars are quoted at 2.15c, valley mill, and refined iron bars at 2 35c to 2.40c, Pittsburg.

STRUCTURAL MATERIAL.—The demand for structural material is excellent and the mills are receiving numerous small orders. The Pittsburg Bridge Co. during the past week received a contract for a steel building to be erected in Detroit. The contract for the John Wanamaker building to be erected in Philadelphia had not been let at latest advices. We quote as follows: Beams and channels, 3 to 15 inches 2.25c; 18 to 24 inches, 2.35c; tees, 2.30c; zees, 2.25c; angles, from 3 to 6 inches, 2.25c. Universal mill plates, 2 10c to 2 20c, according to delivery and size of order.

PIPES AND TUBES.—The National Tube Co. was awarded a contract by the Navy Department this week for 70,000 seamless tubes, aggregating about 500,000 feet of material. The tubes are to be used in equipping the newly-constructed ships of the Asiatic squadron. It is by far one of the largest contracts placed for some time and was secured after considerable lively competition. This company has just completed its order of 18,000 tubes for the Russian government, for installation in the new cruisers which are being built by the Cramps in Philadelphia. Smaller contracts are also numerous and the pipe and tube business is very brisk at the present time. Jobbers all over the country are adopting the discounts lately quoted by the manufacturers, and the following discounts have been put into operation by jobbers at all centers north of the Ohio river and Virginia line, east of St. Louis and Chicago and Milwaukee to the Atlantic coast: Merchant pipe car lots, ⅛ to ⅜-inch, black, 25 and 10, galvanized, 17; less than car lots, black, 25 and ½, galvanized, 10; ½-inch, car lots, black, 25 and three 10s, galvanized, 20, 10 and 2½; less than carlots, black, 25, two 10s, and 2½, galvanized 20, and 5; ¾-inch, car lots black, 25, four 10s and 5, galvanized, 20, two 10s and 2½; less than car lots, black, 25, three 10s and 7½, galvanized 20, 10 and 5; 1 to 4 inches, carlots, 25, four 10s and 7½, galvanized, 20, two 10s and 5; less than car lots, black, 25 and four 10s, galvanized, 20, 10 and 7½; 4½ to 12 inches, car lots, black, 25 and four 10s, galvanized, 20 and two 10s; less than car lots, 25, three 10s, and 2½, galvanized, 20, 10 and 2½.

PLATES.—Tank plates if anything are weaker than they were a week ago. It is reported that one mill accepted a large contract at 1.95c, which however, is considered as having no bearing on the general market. Outside of this contract there is little doing, and what orders are received are small and are taken at advances over quotations for large lots. While the largest steel producer and other mills are holding plates in large lots at 2.10c to 2.15c, two of the mills in this district are quoting from 1.95c to 2c. For assorted widths in small lots, the range is 2.10c to 2 25c. We quote shell steel at 2.20c to 2.30c; flange, 2.30c to 2.40c; fire box, 2.75c to 3.25c.

SHEETS.—It is now authoritatively announced that the sheet consolidation will be consummated next week at a meeting to be held in New York City. All the mills that are to be included in the consolidation were closed down Saturday evening, for the purpose of taking inventory. One of the largest producers of sheets outside of the proposed consolidation this week issued notices to the trade that owing to the large number of contracts on hand it will be unable to take business at the prevailing quotations and is holding black sheets, No. 27 and 28 gauge at 3.20c. We continue to quote 3.05c for No. 27 gauge, and 3.10c for No. 28 gauge, one pass through cold rolls, with some mills asking 3.20c, not being anxious to accept any advance business. Galvanized sheets are firm with 75 the minimum discount and the usual 15-cent freight allowance. For small lots mills are quoting 70 and 10 and 70 and 10 and 5.

OLD MATERIAL.—This market is reported very dull, although the scrap dealers have plenty of available stock. The prices of local dealers show quite a range. Our quotations follow: New basic melting stock, $26 to $29; new Bessemer melting stock, $23 to $25; basic open-hearth scrap, $25 to $28; steel rails, mixed lengths, $23 to $25; short lengths, $23.75 to $25.75; iron rails, $26 to $27; cast borings $13 to $14 gross tons; cast scrap, $18; No. 1 wrought scrap, $23 to $24, net tons; busheling scrap, $17 to $19, net tons.

COKE.—The price of coke continues very high, especially for immediate delivery. Some furnaces are reported as having paid as much as $4.50 per ton. Foundry coke is quoted at $3.75 to $4.50 and furnace coke is quoted at $3.75 to $4.25.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, March 20.

Considerable business in almost every class of material is being placed from day to day in small lots, but no very large orders of any kind are given out, and it is not likely that any will be placed in the immediate future. Several large buyers are short of material, and under ordinary circumstances would be in the market for round lots, but under the present conditions they are somewhat afraid if they announce their wants it will send the prices up on them. So they are making small purchases from time to time, as it is necessary for them to fill in. It is hardly likely, however, that this condition of affairs can last, and much heavier buying may be expected within the next two months, if not before. There are also a good many consumers who have supplied their needs up to the first of July, and between now and then these will have to purchase their requirements for the last half of the year or a part of it. Notwithstanding the comparatively small buying for the past several weeks, the market is very firm in most lines, mills and furnaces generally showing no signs of weakness. The sheet mills that are figuring on going into the combination are all reported to have shut down the first of this week for appraisal.

PIG IRON.—There has been a much better demand for small lots, and good sales of this character were made last week. No very large business was received, and there are no buyers in the market for large lots. Furnaces as a rule are maintaining prices and usually find the buyers willing to pay the asked quotations with no more than the usual haggling. Foundries in this territory continue to run full and are taking the iron as fast as the furnaces can ship it to them. Apparently the local strikes have not affected the foundry business to any extent as yet, although if they continue, as now seems likely, there is little doubt foundries will find the demand for castings fall off to some extent. Several large buyers are said to be short of iron, and to have placed small orders with various sellers, in order to postpone any large buying as long as possible in the hope that by waiting they will secure lower prices than are made at present. Furnaces maintain, however, that there is little likelihood of lower prices being made. Quotations are unchanged as follows:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$20 85 @ $21 85
Local Coke Fdy. No. 1	24 00 @ 25 00	Southern No. 1 Soft	22 85 @ 23 35
Local Coke Fdy. No. 2	23 50 @ 24 00	Southern No. 2 Soft	21 85 @ 22 35
Local Coke Fdy. No. 3	23 00 @ 23 50	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	24 50 @ 25 00	Jackson Co. Silveries	31 50 @ 32 50
Local Scotch Fdy. No. 2	23 50 @ 24 00	Ohio Strong Softeners	24 00 @ 25 00
Local Scotch Fdy. No. 3	23 00 @ 23 50	Alabama Car Wheel	25 00 @ 26 00
Southern Coke No. 1	22 85 @ 23 85	Malleable Bessemer	25 00 @ 26 00
Southern Coke No. 2	21 85 @ 22 85	Coke Bessemer	25 00 @ 26 00

BARS.—It has been reported that one of the large buyers is in the market for a round lot of bars, and that it would buy soon, but this is denied. The business of the week was good, and included several quite good sized lots, and a number of smaller orders. Mills report that good specifications are being received on old contracts all the time, and that their shipments are larger than ever. No changes have been made in prices, which are quoted at 2 30c for iron and 2.35c for steel, half extras, Chicago delivery. The reiterated report that the Indiana mills of the Republic Iron & Steel Co. had closed

down because of the "weekly pay" law is again denied by the officers of the company.

CAR ORDERS.—Some business was done in a small way but no large orders for cars or car material were placedin the week.

BILLETS AND RODS.—The market is quiet with no very large sales of either billets or rods Quotations are $35 for Bessemer billets; $39 for open hearth billets; $37 for sheet bars; $65 for open-hearth rods, and $55 for Bessemer rods.

PLATES.—There is no change in the situation. Some business has been done and a few good orders taken. There is quite a good demand for small lots from store. The market is still weak, but no changes have been made in prices. We quote tank steel from store 2.70c to 2.80c. Mill shipments, Chicago delivery: Tank steel 2.20c to 2.25c; shell, 2.30c to 2.40c; flange, 2.40c to 2.50c; marine, 2.55c to 2.65c; fire box, 2.85c and up, according to brand.

RAILS AND TRACK SUPPLIES.—A few good orders for light sections were placed in the week, but aside from these the market was inactive. Quotations follow: Rails, standard sections, $35 to $38; light sections, $37 to $42; splice bars, 2.50c to 2.70c; spikes, 2.65c to 2 75c; track bolts, 3 85c to 3.95c.

STRUCTURAL MATERIAL.—Buying has been confined to small lots. Conditions are about as they have been for some time past, contractors waiting for a settlement of the labor difficulties before going ahead with work. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates 2 50c to 2.60c; universal plates, 2.50c to 2 65c; tees, 2 45c zees, 2.40c; small lots from store are quoted ¼c to ⅓c higher.

SHEETS.—Most mills are shut down for appraisal before being taken into the sheet mill combination, and are practically out of the market for the present. Some business is being done by outside mills, and by brokers who have unfilled contracts for material with the mills. These in some cases offer material at figures slightly under the schedule, which is unchanged at 3.20c to 3.30c for No. 27 black and 75 per cent off for galvanized.

MERCHANT STEEL.—The local demand is very small, the strikes in machine shops having cut off buying for the present. Business from outside buyers is good, and several quite good orders were closed in the week. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—Most buying was in small lots, although it is reported one or two good sized orders were taken in the week. Quotations are unchanged, discounts being as follows: Black merchant pipe, ⅛, ¼, and ⅜-inch, 25, 10 and 5 per cent; ½-inch, 25, three 10's and 4; ¾-inch, 30, four 10's and 4½; 1 to 4 inches, 30, four 10's 5 and 1½; 4½ to 12 inches, 30, three 10's and 8; galvanized, 15 points less discount in the base. Iron boiler tubes, 1 to 1½ inches, 20 and 3½; 1¾ to 2¾ inches, 20 and 10; 2¾ to 8 inches, 30, two 10's, 5 and 3; 2½ and 9 to 13 inches, 30, 10 and 1½.

WIRE AND WIRE NAILS.—Business continues good, and the demand appears to be increasing steadily. Sales last week were ahead of those of the week previous somewhat. Prices are still unchanged and there is no immediate change in sight. Makers quote single car loads of wire nails at $3.53, f. o. b. Chicago, and $3.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.38; painted barb wire, $3.98; galvanized barb wire, $4.13.

OLD MATERIAL.—Some buying was done last week by outside consumers, and a few good sales were made in the city. The demand is somewhat better, and a larger business is looked for. The market is unchanged, dealers' selling prices being about as follows:

Old iron rails, gross,	$24 00@$25 00	Country malleable	$14 00
Old steel rails, long, gr.	22 00	Iron axles, net	$27 00@28 00
Old steel rails, mixed	19 00@19 50	Cast borings, net	9 00@10 00
Relaying rails, gross	28 00@30 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	24 00@24 50	Iron axle turnings, net	14 00@15 00
Railroad forge, net	24 00	Steel axle turnings	12 00@12 50
Dealer's forge, net	16 50@17 00	Mixed country steel, gr	13 50
No. 1 cut mill, net	14 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@15 00	Heavy melting steel, gr	18 00@19 00
Railway malleable, net	15 00	Old iron splice b., net	26 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., March 21.

The local market is quiet in all departments. The arrangement of the wage schedules between the dock companies and the longshoremen's unions is on a basis that gives the men a liberal share in the prosperity of the ore trade, and to all appearances will insure the steady and effective operation of all the ore-handling equipment on Lake Erie. Thus far the indications from upper lakes are not favorable to an early opening. Ice is heavy and several weeks of genuine spring weather will be required to dispose of it. Reports from the mines show a very saitsfactory winter's output, and the recent advances in wages insure a maximum working force.

PIG IRON.—Furnacemen in the valleys are straining every nerve to maintain the rate of production of the past few months, but the general experience is that limitations appear, at every turn. Mabel Furnace was shoveled out the past week and will be out for a week or 10 days for slight repairs. The practical certainty that interruptions will come this season, in view of the long campaigns most of the valley furnaces have had, is a feature of the situation that must be reckoned with. Consumers of Bessemer are urging deliveries and the continued new demand for the metal reflects the pressure upon every source of Bessemer steel supply in the Central West, particularly in the lines that end in wire and wire nails. We note some further sales of Bessemer at $24. Some indications appear that more metal has been sold for delivery in the first half of the year than will be yielded by furnaces now active, and the presumption is that several furnaces of steel companies will need to go out in the next six months. Foundry iron is quiet, with an easy feeling but not enough new business coming up to test the possibilities in the way of concessions. Thus far the Central West seems to have held prices better than the East. Small lot tranasctions at $22 and as high as $22.50 at furnace for No. 2 are reported. Furnaces will sell for immediate shipment where lots of certain grades are on hand, at lower figures than for shipment in the next three to six months. In forge iron we note a prompt sale of Southern at $19.95 delivered in the valley, or $15.50 Alabama furnace. For delivery beginnng the second quarter, and extending into the third $16 at Southern furnace is a minimum. On Southern foundry recent quotations have varied from $17 to $17.50 at furnace for No. 2, according to time of delivery and depending also on the brand, whether well-known or from a recently started furnace. We quote the Cleveland market on Northern irons:

Bessemer	$24 90	Valley Scotch No. 1	$23 00@23 25
No. 1 Strong Foundry	22 75@23 25	Valley Scotch No. 2	22 50@22 75
No. 2 Strong Foundry	22 25@22 75	Gray Forge, valley	20 50@21 00
No. 3 Foundry	21 50@21 75	Lake Superior Charcoal	25 00@26 00

FINISHED MATERIAL.—The calendar shows the arrival of spring, but there is no revival of the demand as yet. Meanwhile prices in certain lines, bars in particular, are maintained in a surprising way. We still quote 2.15c, valley mill, for bar iron, though in Eastern territory competition is evidently being met. Steel bars are generally being held at 2.35c Cleveland, though there are rumors that the agreed prices of February have been shaded at Pittsburg. At Toledo a vessel contract that has been figured on for weeks is still hanging. In plates prices have dropped about $5 a ton since figures were first sought on this contract, and though the object of the wait has been accomplished in this respect, the slim chance of getting any use of the vessels this season may cause their postponement. Considerable bridge business has been taken in Northern Ohio recently, and bars, plates and angles have been covered. Some of the plates went at 2.15c at mill, though $2 to $3 below this has been done, at Pittsburg mill. Sheets are firm and one producer has advanced prices, holding for 3.20c, Pittsburg, for No. 28. Wrought pipe is in good demand and the new prices are being readily paid.

OLD MATERIAL.—The market has not been as active as in February, and local dealers who made consierable sales and few weeks ago, are not attempting to push business under the conditions in finishing lines. We quote the Cleveland market: Old iron rails, $24 to $25; old steel rails, $20 to $21; old car wheels, $22, gross tons; No. 1 railroad wrought scrap, $20 to $21; mill scrap, $14 to $15; No. 1 machinery scrap, $15.50 to $16; iron axles, $26; wrought turnings, $12 to $13; cast borings, $10 to $11; grate bars, $10; stove plate, $10 to $11.

WIRE AND WIRE NAILS.—Local plants are running to

their fullest capacity and the demand for nails is excellent. The wire trade is more active as open weather approaches. We quote f. o. b. Cleveland to retailers: Wire nails, $3.45; smooth wire, $3.30, painted barb wire, $3.90; galvanized, $4.05.

CINCINNATI.

March 20.

Matthew Addy & Co. say: "The past week has been featureless unless, indeed, a steady increase in the volume of new business can be considered as a feature. Trade is not monotonous, for inquiries are plentiful and orders while not large are still not lacking. The inquiries indicate that a great many concerns are feeling the market. It is evident that before long considerable buying must be done, in fact already many foundries are running near the danger line in the matter of their supply of pig iron. In the South the situation is not at all improved. Labor troubles while not general are still of frequent occurrence. The weather has been decidedly unfavorable, and there is not a furnace stack that has not been troubled to get a satisfactory and sufficient supply of raw materials. It had been hoped by this time that all of these troubles would have been a thing of the past, but they are still interfering with regular furnace operations. There never has been a time in the history of the South when the furnaces have made so little 1, 2 and 3 foundry in proportion to other grades as now. In fact Nos. 1 and 2 foundry are almost impossible to obtain."

Rogers, Brown & Co. refer to the local market and the general situation as follows: "The general market the past week has been devoid of any special excitement or features of extraordinary interest. During January and February stock in the hands of consumers were reduced, it is believed, a very much greater tonnage than the furnaces increased. The business of the week has been conservative and has developed no striking changes. The furnaces in the main have been working irregularly, and supplies of standard grades have been inadequate. There is a great scarcity of charcoal irons in chilling grades. Irons for malleables and car wheels, both coke and charcoal, are in demand beyond possible supply, as are also Southern irons in No. 2 foundry and No. 2 soft. The principal tonnage of the week has been in gray forge and high silicon No. 3 and No. 4, though there has been a good run of orders for regular foundry irons, both Northern and Southern.

We quote for cash f. o. b. Cincinnati: Southern coke, No. 1 foundry, $21.75; No. 2 foundry, $20.75; No. 3 foundry, $19 25; No. 4 and gray forge, $18.75; No. 1 soft, $21.75; No. 2 soft, $20.75; Lake Superior coke No. 1, $23.25 to $23.75; Lake Superior coke No. 2, $22.25 to $22.75; Hanging Rock charcoal No. 1, $25 to $26; Jackson county silvery No. 1, $30 to $31; Standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25 50 to $26.50.

PHILADELPHIA.

March 20.

The condition of an abundance of work at mills and foundries with prospects of more as the season of spring activity advances, is accompanied by keen competition for orders. The question has arisen whether some mills that are eager now for new business at the prevailing prices will not find a little later that they have been too ready to accept this basis for forward delivery As a rule, however, a difference is made between early and later deliveries, and most producers are keeping pretty close up on their engagements. It does not appear that work is being put off on account of the high prices to such extent as had been expected. The demand for material for buildings and bridges is expected to be prodigious in the coming season. Such mills in this section as buy their own raw material find no very attractive margin between present prices for their finished product and the prices they are asked to pay for billets and slabs. The tendency will be from this time on, it is believed, for such mills to get somewhat better prices for what they sell, and thus there will gradually be an advance from the low level of February and March in plates and bars. The plate market is close to a 2-cent basis for tank, but it is considered in some quarters that the minimum has been touched and that the tendency will now be toward firmer prices.

As a rule, both in pig iron and in finished material, buyers are restricting their contracts to the narrowest limits. In pig iron new brands and other than standard grades are sold at comparatively low figures. The more desirable brands are not plentiful enough to cause any special cutting. We quote No. 1X foundry at $23 50 to $24; No. 2X foundry at $22.50 to $23; No. 2 plain at $21.50 to $22; gray forge, $19 to $19.50; baisc iron, $22 to $22.50. Deliveries are heavy and furnaces are not increasing stock to any extent. It is estimated that the depletion of stocks on foundry yards is greater than the accumulation by the furnaces. In general the feeling in finished lines is not so strong as in the early part of the month. In plates 2.05c to 2.10c is the quotation for ¼-inch and thicker. Bars are a shade weaker than at last report. We quote refined bars at 2.10c to 2.15c; angles 2.40c to 2.50c; beams and channels, 2.40c to 2.50c.

OBITUARY.

Charles Rogers Brown, manager of the railway department of the Michigan Malleable Iron Works, Detroit, Mich., and well known to railroad men all over the United States, died at Harper hospital, Detroit, March 11, after an operation. Mr. Brown was born in Boston, 42 years ago. He was engaged for a number of years in the promotion and construction of railroad lines in Tennessee and other Southern States, and prior to going to Detroit was manager of the sales department of the Illinois Steel Co.

John Griffith, for many years superintendent of the Springfield Iron Works, Springfield, Ill., and who remained in that position after the works became part of the Republic Iron & Steel Co., died at Springfield, March 16, of paralysis.

Walter Nishwitz, Baskingridge, N. J., proprietor of large agricultural implement works at Millington, N. J., died last week aged 70 years. Twenty-five years ago Mr Nishwitz invented a mowing machine and sold this patent to the Walter A. Wood Co. for $100,000. Shortly after this he patented the Acme harrow, and built a factory at Millington, N. J.

Andrew Bolter, founder of the firm of A. Bolter Sons, foundrymen at Chicago, died March 17, aged 80 years. Mr. Bolter was born in Sigmaringen, Germany, and came to this country in 1856. He had been in business in Chicago nearly all the time since, retiring from the active management of the business in 1891, when it devolved upon his sons, Edward A. and Joseph C. Bolter. Mr. Bolter was an enthusiastic entomologist, and was a charter member of the Chicago Academy of Sciences and a corresponding member of the Academy of Science of Philadelphia, and of the Entomological Society of New York.

George B. Sennett, president of the Geo. B. Sennett Co., of Youngstown, O., died in that city Sunday, March 18, after an illness of four weeks. He was born in 1840, and for 35 years had been identified with manufacturing operations in the Central West. His father was a pioneer foundryman of Western Pennsylvania. At 20 years of age he traveled abroad and for several years studied in Paris, Berlin, Leipzig and London. In 1865 he engaged in the building of oil machinery in Meadville and five years later was called to Erie by the death of his father. The management of the estate occupied him for the next few years, and he devoted considerable time to natural history, particularly ornithology. He was best known as an authority in the latter specialty. In the 70's he went to Texas to study the birds of that section, many of them being unknown, and several expeditions were equipped by him in the same interest. Several years ago his scientific collection, which is one of great value, as it contains several types discovered and named by him, in the American Museum of Natural History in New York for the use of students in natural history. As an ornithologist Mr. Sennett was known all over the world, and he numbered among his friends many scientific men, both at home and abroad, being a member of the American Ornithologist's Union, Metropolitan Museum of Art, Museum of Natural History, and Manhattan Club, and of foreign scientific societies. He was a prolific writer on ornithological subjects and a frequent contributor to ornithological periodicals. In late years he devoted much time to a work on birds of Texas, for which he had drawings prepared of the birds he discovered. The Geo. B. Sennett Co.'s works at Youngstown, O., were established in 1896, being removed from Meadville, Pa., where a machine shop and foundry had been operated for a number of years.

THE IRON AND STEEL STOCKS.

Fluctuations of the Week and the Year.

The table below shows the changes in the iron and steel stocks in the week ending March 19, also the high and low points for the year, as reported by Denison, Prior & Co.:

Name.	WEEK.				YEAR.					
	Open	High	Low	Close	High.			Low.		
Am. Car & Fdy.....	14⅜	17	14⅜	16⅜	18	Feb.	7	12⅜	Jan.	15
Am. Car & Fdy pr.	62⅜	65¼	62⅞	65⅛	66	Feb.	6	59	Jan.	29
Am. Steel & Wire..	56¾	57¼	54⅜	54⅜	59¾	Feb.	16	45¾	Jan.	15
AmSteel & Wire pr	91¼	92	90¾	90¾	95	Feb.	1	89	Jan.	15
Am. Steel Hoop.....	33¾	37¾	33	35	50½	Feb.	6	32	Mar.	6
Am. Steel Hoop pr	80	81	80	81	86	Feb.	6	79	Mar.	1
Am. Tin Plate.....	33	34	32	34	36¾	Feb.	7	27⅞	Jan.	29
Am. Tin Plate pr..	82	82	82	82	84	Feb.	16	80⅛	Jan.	22
Col. Fuel & Iron..	43½	45⅝	43	44⅞	48½	Feb.	6	40½	Jan.	8
Federal Steel.....	49¾	51¾	49⅜	50	57⅜	Feb.	6	47⅞	Jan.	11
Federal Steel pr....	73	74	73	73½	77⅛	Feb.	6	70¾	Jan.	10
National Steel.....	43⅜	46	43½	45½	53½	Feb.	6	40	Jan.	26
National Steel pr..	95⅞	97	95	95⅛	97	Feb.	6	92	Jan.	9
Pressed Steel Car..	53½	53⅝	52¾	52½	58¾	Jan.	17	48	Mar.	6
PressedSteelCar pr	86	86	85¾	85¼	88¼	Jan.	17	85	Mar.	2
Republic Steel	21⅛	22⅜	21⅜	21⅜	27½	Feb.	6	19⅜	Jan.	15
Republic Steel pr..	67¾	68	66	66½	70¾	Feb.	6	64¾	Jan.	18
Tenn. Coal & Iron	92	96¾	92	94¾	104	Feb.	2	79¾	Jan.	11

Notes.

The annual report of the National Steel Co. made at the annual meeting at Orange, N. J., March 20, shows a surplus of $7,323,719 for the year ended Feb. 28. The directors whose terms expired were re-elected. The directors met and voted to charge off improvements made during the fiscal year, at $3,617,329. The following statement was made at the meeting: Assets—Plants, real estate, machinery, etc., $49,375,510; improvements, $3,617,329; investments in ore, coke, coal properties, furnaces and boats, $11,058,287; inventories, $3,170,550; advance on ore on docks, $1,754,045; accounts receivable, $3,511,394; cash, $4,125,219. Total, $76,612,335. Liabilities—Capital stock, preferred, $27,000 000; capital stock, common, $32 000,000; contracts due on ore properties and boats, due Aug. 1, 1900, $1,640,491; due Aug. 1, 1901, $2,239,349; purchase money, mortgages assumed, $4,471,000; accounts payable, $1,937,774; surplus, $7,323,719. Total, $76,312,335. The treasurer said that the question of a dividend on the common stock had not been discussed by the directors. Under New Jersey laws action on this matter cannot be taken until after the payment of the full year's dividend on the preferred.

The preferred and common issues of the National Tube Co., —$40,000,000 each—were admitted to the regular list of the New York Stock Exchange March 14. The statement shows that the estimate of a $3,000,000 saving a year by consolidation is being realized. For the six months since the National Tube Co. started, viz., July 1 to Dec. 31, 1899, the net earnings of the corporation, after appraising all materials on hand at very low figures, amply to guard against contingencies of all kinds, and after making full provision for depreciation, etc., were, as certified by public accountants, $7,911,510.12; from this deduct two dividends on preferred stock of 1¾ per cent each, $1,400,000; leaving (as the result of six months' dividends on preferred stock), $6 511,510.12. In December, 1899, the Riverside Iron Works were merged and the entire assets and liabilities are now incorporated in those of the National Tube Co.

At the annual meeting of the Tennessee Coal, Iron & Railroad Co., at Nashville, Tenn., March 14, some changes were made in the board of directors, the names of Col. Henry S. Manning, of Manning, Maxwell & Moore, B. Y. Frost, Frank Witherbee, Fred H. Benedict and Walter S. Percy appearing in place of John G. Moore, Walker S. Gurnee, Jr., Walter S. Gurnee, Sr., E. C. Benedict, and A. T. Smythe. President Baxter, Vice-President Shook and Treasurer Bowron were re-elected. The report showed that the output of coal, coke ore, limestone and pig iron in 1899 was 7,573,690 tons against 6,420,869 in 1898. Early in the year the Sheffield Coal, Iron & Steel Co.'s property was purchased at $850,000. Certain railroad lines were transferred to Birmingham Southern for a consideration, including $1,00,000 cash, the company to carry products of Tennessee company. On issuance of new stocks President Baxter says: "It will also be proposed by suitable resolution at annual meeting that another $1,200,000 common stock be authorized and issued, in addition to the $1,800,000 required for carrying out purposes of preceding paragraph."

A dividend of 2 per cent on the common has been declared, being the first since 1887. The company has also declared a divdend of 54 per cent on its non-assenting preferred stock, and it has extended the time for preferred stockholders to exchange their holdings on a basis of 80 shares of common for 100 shares of preferred until April 9. The report showed a profit of $1,864 179 on mining and transportation, and after deducting interest accrued, $577,832, and guarantees, the surplus is $1,210,911, as against $224,976 for 1898. The net funded debt, Dec. 31, 1899, was $9,078,420, not including the $1,100,000 6 per cent bonds of the Alabama Steel & Shipbuilding Co., on which the Tennessee company has guaranteed principal and interest. On account of the purchase of the Sheffield Coal, Iron & Steel Co.'s property, the floating debt shows an increase for the year of $369,301. On the other hand there has been an increase in quick assets of $1,026,324, in slow assets of $21.563 and in ultimate assets of $286.785, a total increase of $1,3°4 672 in value of assets, or a betterment of the company's position as to floating debt, of $965,371. The floating debt amounts to $2,478,994, but the total assets against it amount to $3,777,235.

The liabilities statement shows $20,000,000 common stock, $1,000,000 preferred stock, $440,000 stock and $1,100,000 bonds of the Alabama Steel & Shipbuilding Co., $9.078,419 bonded debt, $1.137,707 bills payable, $853,748 to sundry creditors, $1,307,962 profit and loss, and other items making together a total of $35.355,375.

The next quarterly dividend of 1¾ per cent on the preferred stock of the Republic Iron & Steel Co. will be paid April 2.

Personal.

G. G. McMurtry, president of the Apollo Iron & Steel Co., is expected to arrive in Pittsburg this week from abroad.

Alex. Crawford has resigned as manager of the Terre Haute, Ind., mill of the Republic Iron & Steel Co.

Dr. Richard G. G. Moldenke, of Pittsburg, delivered an address on "The Copper Regions of Lake Superior," at the March meeting of the Calvary Church Brotherhood, in the parish building, Pittsburg, Monday evening, March 19.

Charles G. Washburn, formerly of the Washburn & Moen Co., will be president of the new Washburn Wire Co., and John D. Curtis will be general manager.

Robert Ramsey, Jr., has resigned the presidency of the H. C. Frick Coke Co.'s Standard plant, and will go to Stonega, Va., where he will take a similar position with the Virginia Iron, Coal & Coke Co.

THE Riter-Conley Mfg. Co., Pittsburg, was awarded the contract last week for the construction of a 400-ton blast furnace for the Iroquois Iron Co., of South Chicago, controlled by Rogers, Brown & Co. The Riter-Conley Co. has been given one year in which to complete the furnace. The machinery, blowing engines and pumps will be supplied by the E. P. Allis Co., of Milwaukee. The work of erecting the furnace will be under the supervision of Julian Kennedy, the well-known Pittsburg engineer. The furnace will be 80 feet high and will be 20 feet in diameter at the bosh. It will have four hot blast stoves each 85 feet high and 18 feet in diameter and the steel chimney will be 200 feet high.

PAPERS have been filed in the United States Court at Pittsburg by the Wheeling Corrugating Co., of West Virginia, and the Scully Iron & Steel Co., of Illinois, who are acting jointly against the Old Meadow Rolling Mill Co., of Scottdale, Pa. Some time ago the plaintiffs began suits in the United States Circuit Court for claims of indebtedness amounting to $25,000 by the Wheeling Corrugating Co., and $21,787 by the Scully Iron & Steel Co. These suits are now pending. It is claimed in the petitions just filed that the Old Meadow Rolling Mill Co. is about selling out its plant to a new company to be organized in New Jersey and that this would place the assets of the company out of the reach of the plaintiffs. The court is asked to enjoin the transfer.

THE Detroit Machinery and Metal Manufacturers' Association was organized last week with the following officers: President, E. T. Gilbert; vice-president, James Inglis; treasurer, Andrew Harvey; secretary, George A. True. About 15 manufacturers were present and it is expected that every manufacturer in the metal trades will be included. The association is formed for the handling of labor questions, after the plan of the Chicago, Cleveland, Columbus and other organizations.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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MARCH 22, 1900.

THE MACHINISTS' STRIKE GOES ON.

The officers of the National Metal Trades Association journeyed to Chicago last week to meet the officers of the International Association of Machinisits, with a reasonable expectation that the strikes now in progress would be ended and that impending troubles involving tens of thousands of employees, would be averted. In another column details are given of the advance made by the manufacturers toward a settlement, and of the fruitlessness of the conference because of the inability of the officers of the machinists' union to control the Chcago strikers. Ostensibly, and perhaps really, the union officials were favorable to the principle of arbitration and, pending adjustment, the resumption and continuance of operations. If there is any *bona fides* in the submission of the disputed labor questions to the arbitrament of a committee of reasonable men, one of the best proofs of its existence is the immediate restoration of the status that preceded the strike. Even in deadly warfare an armistice is an approved preliminary of peace negotiations. Yet this Chicago wing of the union machinists' army, in a dispute that presumably involves no weapons and no physical violence, insists on carrying on the war ever after handing its case over to arbitrators whose decision is to be binding on both parties.

It has been a foundation principle in the relations so successfully maintained by the stove founders and the stove molders over a period of yeras, that when differences arise work shall continue. And if through the action of hot heads and insubordinate members on either side, work has been stopped, either through strike or lockout, not a single step can be taken toward a settlement until the status has been restored and the relations of employer and employe resumed. The National Founders' Association has adopted and has worked with eminent success the same principle, and it has been recognized by the Iron Molders' Union. It has remained for the machinists' organization, that has laid claim to special skill and intelligence, to take a backward step, insisting on arbitrating with its arms in its hands and every man in the attitude of conflict.

The situation that exists in consequence of the Chicago machinists' decision is deplorable. It may be said here and now that the strike is lost. But the men, if determined to butt their heads against the wall, have the privilege of inflicting harm upon themselves and incidentally causing loss to their employers and many outside interests. Manufacturers who have been alive to the necessity of presenting a united front to a demand that involves the control of their business, now find that organized effort is the only method of making their strength felt, and the National Metal Trades Association has very rapidly become a power in directing the present contest.

It is estimated that upwards of 120,000 machinists, perhaps half of them union men, will be involved in the strike now contemplated by the union. Manufacturers are aroused to the danger threatened not only to capital but to intelligent labor, in the domination of shop operations by a coterie of labor leaders, and by the enforcement of a policy that means the surrender of manhood and the quenching of ambition. Whatever the cost, they are determined that the issue shall be met and every resource employed to resist demands so unjust and un-American.

OPEN DOOR TO AMERICAN STEEL WORKS.

In our last issue we quoted the statement of a German manufacturer, who found a difference in the welcome he received at Pittsburg works in a recent visit, and that of ten years before. In 1890, on the Iron and Steel Institute trip, everything was wide open and he and other visitors refused many invitations on the ground that little was to be learned from American practice. Recently when the desire was present it is reported that the willingness of Pittsburg mill managers was no longer in evidence. An English contemporary, commenting on the incident, observes that American steel manufacturers are getting more and more chary of granting facilities for inspection and prophesies that in time Englishmen will have to content themselves with an exterior view of Pittsburg's manufacturing establishments. As a rule Pittsburg steel companies have been very ready to give engineers and maufacturers from the other side every facility for free inspection of their works. Indeed their liberality in this regard has been commented upon and wondered at even by those who made requests for such favors. One gentleman, whose thorough acquaintance with the works side of his company's affairs is well known, has gone to the length of sending blue prints of various improvements, in response to inquiries from British and Continental investigators. It has been intimated that he did this because of his perfect confidence in the inadaptation of these innovations abroad. The fact that their adoption would only throw established practice out of joint was considered the strongest guarantee that they would never be borrowed. Perhaps when a fair beginning is seen of a disposition to replace the old types of foreign blast furnaces and of steel

works equipment with the best that has been evolved in the United States, the present open policy of the leading steel manufacturers may be modified. The genius of the American advance in steel making does not flourish abroad as yet, with the vigor of its native clime.

An English manufacturer said recently to a visiting machinery manufacturer from the United States: "We in England may have a good many old machines, but they are good yet and we use them." "With us," replied his American friend, "it is enough to know that a machine is old; that makes sure that it is not good." The two remarks are typical, and as long as the conditions and habits they represent continue as they are we shall hear little on this side of the dangers of the "open door" policy at American steel works.

Discounts on Merchant Pipe.

The following discounts have been put into operation by the jobbers of pipes and tubes at all centers north of the Ohio River and Virginia line, east of St. Louis, Chicago and Milwaukee to the Atlantic coast:

MERCHANT PIPE.	CAR LOTS.		LESS THAN CAR LOTS.	
	BLACK.	GALVANIZED.	BLACK.	GALVANIZED.
⅛ to ¾ in	25 & 10	17	25 & 2½	10
½ in	25 & 3 10s	20, 10 & 2½	25, 2 10s & 2½	20 & 5
¾ in	25, 4 10s & 5	20, 2 10s & 2½	25, 3 10s & 7½	20, 10 & 5
1 in. to 4 ins	25, 4 10s & 7½	20, 2 10s & 5	25 & 4 10s	20, 10 & 7½
4½ ins. to 12 ins	25 & 4 10s	20 & 2 10s	25, 3 10s & 2½	20, 10 & 2½
1 in. to 4 ins. Plug'd and R'm'd	25, 4 10s & 2½	20, 2 10s & 2½	25, 3 10s & 5	20, 10 & 5
CUT 3 TO 6 FT.				
⅛ in. to ⅜ in	20 & 2½	5	17½	2½
½ in	25, 10 & 7½	20	25 & 10	12½
¾ in	25, 3 10s & 2½	20 & 10	25, 2 10s & 5	20 & 2½
1 in. to 4 ins	25, 3 10s & 5	20, 10 & 2½	25, 2 10s & 7½	20 & 5
4½ ins. to 12 ins	25, 2 10s & 5	20 & 5	25 & 2 10s	20
CUT 6 FT. & LONGER.				
⅛ in. to ⅜ in	25 & 2½		20	2½
½ in	25 & 2 10s	20 & 2½	25, 10 & 2½	17½
¾ in	25, 3 10s & 5	20, 10 & 5	25, 2 10s & 7½	20 & 7½
1 in. to 4 ins	25 & 4 10s	20, 10 & 7½	25, 3 10s & 2½	20 & 10
4½ ins. to 12 ins	25 & 3 10s	20 & 10	25, 2 10s & 2½	20 & 2½
X STRONG, P. E.				
⅛ in. to ½ in	25 & 10		25 & 2½	
¾ in. to 2 ins	25, 2 10s & 5		25, 10 & 7½	
2½ in. to 8 ins	25, 10 & 7½		25 & 10	

An Advance for Stove Molders.

The Stove Founders' National Defense Association, whose representatives were in session at Atlanta, Ga., last week with officers of the Iron Molders' Union, of North America, agreed to advance the wages paid molders 15 per cent over the figures in effect in 1898. This is an important wage settlement that has been watched with interest by founders in all parts of the country. The stove founders and stove molders, while they have their disagreements, have been a pattern to employers and employees in all lines, in their splendid exemplification of conciliation and mutual concession, in their conferences over labor questions. There were possibilities of serious disagreement in the matters discussed at Atlanta, and it is a matter of congratulation that the two bodies, consistent with the history of their dealings covering successive years, have arrived at a basis on which operations will go on without interruption.

SUIT was begun in the United States court at Pittsburg March 19 by the Shelby Steel Tube Co. against Henry G. Wasson, as trustee, who it is alleged is manufacturing seamless tubing at Beaver Falls, Pa., using the Stiefel patents or material parts of them in his machinery. Injunction and damages in $150,000 are asked. The same plaintiff has filed suit at Jersey City in United States Circuit Court against the Atlantic Tube Co., asking similar damages and judgment.

THE Berlin Iron Bridge Co., of East Berlin, Conn., opened an office at Rooms 905-910 Stephen Girard Building, Philadelphia, March 15. The office will be in charge of L. H. Brumbaugh, who has been with the bridge company for a number of years.

Chicago Strike Conference Fruitless.

It has been expected that a settlement of the machinist's strike would be reached at a conference which was held in Chicago on Saturday, March 17, between the officers of the National Metal Trades Association and officers of the International Association of Machinists; but unfortunately an agreement could not be reached, and the strike is still in progress, at present giving promise of continuing for an indefinite time.

The conference in Chicago was attended by the following members of the Administrative Council of the National Metal Trades Association: President Geo. D. Selden, Erie City Iron Works, Erie, Pa.; vice-president, F. H. Stillman, Watson & Stillman, New York City; treasurer, H. N. Covell, Lidgerwood Mfg. Co., Brooklyn, N. Y.; secretary, A. J. Caldwell, Henry R. Worthington, New York City; N. H. Barker, American Tool Machine Co., Boston, Mass.; Geo. A. Watts, Watts-Campbell Co., Newark, N. J.; H. M. Leland, Leland & Faulconer Co., Detroit, Mich.; J. W. Gardner, Gardner Governor Co., Quincy, Ill.; Charles Allis, E. P. Allis Co., Milwaukee, Wis.; Fred. Schwedtmann, Wagner Electric Mfg. Co., St. Louis, Mo.; F. W. Pillsbury, F. W. Wolf Co., Chicago. There were also present P. W. Gates and H. W. Hoyt, of the Gates Iron Works, Chicago; W. J. Chalmers, of Fraser & Chalmers, Chicago; W. M. Taylor, of the Chandler & Taylor Co., Indianapolis, Ind.; and Chas. R. Newcombe, of the Erie City Iron Works, Erie, Pa. The International Association of Machinists was represented by President James O'Connell, Washington, D. C.; Organizer Stuart Reed, Toledo, O; Hugh Doran, Chicago; A. W. Holmes, Buffalo; P. J. Conlin, Sioux City, Iowa, and J. J. Connolly, of Boston.

Separate meetings of the two associations were held during the day, and in the evening a joint meeting was held at 8 o'clock at the Grand Pacific Hotel, lasting until after midnight. The object of the meeting was to arrange for national arbitration of any differences that might exist between any members of the two organizations, but the object was not attained as the executive committee of the machinists' union refused to sign the agreement which was presented by the officers of the National Metal Trades Association. This agreement, in full, is as follows:

The Proposed Arbitration Agreement.

"WHEREAS, The National Metal Trades Association, party of the first part hereto, is a voluntary association of employers, persons corporate and individual, and firms, members thereof, and

"WHEREAS, the said National Metal Trades Association claims to represent and does in fact represent all such persons, its members with power and authority to act for such members, and

"WHEREAS, The International Association of Machinists, party of the second part hereto, is a voluntary association of employes, members thereof, claiming to represent and in fact representing such members, both the grand lodge thereof, the district lodges thereof, and the local lodges thereof, throughout the United States and Canada, and

"WHEREAS, there now exists and may hereafter exist or occur a condition of industrial disturbances and cessation of contract relations between employer and employes, commonly called lockout or strike, in the United States and Canada, and

"WHEREAS, the undersigned, George D. Selden, F. H. Stillman, M. H. Barker, George A. Watts, H. M. Leland, J. W. Gardner, Charles Allis, Fred. Schwedtmann, H. N. Covell, Fred. F. Stockwell, Nathan B. Payne, J. A. Jeffry, F. W. Pillsbury, H. F. Crandall, and N. O. Nelson are a lawfully appointed committee to represent and bind by these presents hereto, the said National Metal Trades Association and all members thereof, and

"WHEREAS, the undersigned are a lawfully appointed committee with authority to represent and bind by these presents hereto all members of the International Association of Machinists, now, therefore

"This agreement made this seventh day of March, 1900, between said committee acting for and representing said

National Metal Trades Association, and said committee acting for and representing said International Association of Machinists,

Witnesseth: "The parties hereto believing in the principle of national arbitration in settling contentions that arise between employer and their employes, instead of resorting to lockouts and strikes, do hereby recommend for ratification by the two organizations known as the National Metal Trades Association and the International Association of Machinists, the following joint agreement:

Principles of National Arbitration Endorsed.

"WHEREAS, the past experience of the National Metal Trades Association and the International Association of Machinists, justifies the opinion that mutual agreements conducing to greater harmony in their relations as employers and employes will be of advantage, therefore

"*Resolved*, That this committee of conference endorse the principle of national arbitration in the settlement of trade disputes, and recommend the same for adoption by the members of the National Metal Trades Association and the International Association of Machinists. Be it further

"*Resolved*, that in all pending disputes, and disputes hereafter to arise between members of the respective organizations, i.e., an employer and his employe or employes, every reasonable effort shall be made by the said parties to effect a satisfactory adjustment of the difficulty; failing in which either party shall have the right to ask its reference to a committee of arbitration which shall consist of the presidents of the National Metal Trades Association and of the International Association of Machinists, or their representatives, and two other representatives from each association appointed by the respective presidents. The finding of this committee of arbitration by a majority vote shall be considered final as regards the case at issue, and as marking a precedent for the future action of the respective organizations. Pending adjudication by the committee of arbitration there shall be no cessation of work at the instance of either party to the dispute. The committee of arbitration shall meet within two weeks after the reference of the dispute to them.

"This agreement shall take effect from the date of its ratification by the said two associations, notice of which ratification shall be promptly given to each other by the respective secretaries.

"And it is further agreed that during the time necessary for the ratification hereof as above provided and the time needed to consider and act upon the above proposed joint agreement, there shall be no lockout or strikes in either association and all lockouts or strikes that now exist and are participated in by the members of either of the parties to this agreement shall be immediately and officially called off wherever they may exist."

Chicago Machinists Uncontrollable.

"The last clause of the agreement is what caused the difficulty. The leaders of the Chicago lodge of the International Association of Machinists refused to agree to call the local strike off until after the agreement had been signed and the differences existing between the men and their employers arbitrated. The National Metal Trades Association could not agree under their rules to arbitrate while a strike was in progress, and with this radical difference between the two associations it was impossible for them to get together on any proposition whatever. It was stated by the members of the executive committee of the International Machinists' Association that they desired to have the local strike called off until the matter could be arbitrated, but that they were unable to control the local organization. The members of the National Metal Trades Association argued that if the national officers of the Machinists' Association could not control the local lodges now it would be impossible for them to do so in the future.

The Manufacturers' Statement.

The members of the National Metal Trades Association adopted the following resolutions, which express fully their view of the matter:

"WHEREAS, The administrative council of the National Metal Trades Association has met in Chicago for the express purpose of considering the question of adopting a joint agreement with the executive officers of the International Association of Machinists relating to the arbitration of any differences that may arise between the members of the two associations, and

"WHEREAS, The call for this meeting was issued upon the express understanding that the president of the International Association of Machinists, in consultation with Mr. Hoyt, a member of this association, had not only approved of the general form of the agreement endorsed by the National Metal Trades Association this day, but had signified his intention to call his executive council together to ratify the said form of agreement; and

"WHEREAS, The executive committee of the International Association of Machinists now refuses to sign said agreement, giving as a reason therefor that they cannot control the local unions and will not order men back to work prior to arbitration taking place and being concluded; and

"WHEREAS It is the fundamental principle of the National Metal Trades Association to arbitrate labor disputes only in the absence of strikes and lockouts; now, therefore be it

"*Resolved*, That the form of joint agreement this day unanimously adopted by the administrative council of the National Metal Trades Association and presented to the executive officers of the International Association of Machinists is the best and only proposition which the National Metal Trades Association has to make. And that the committee again presents the agreement to the executive committee of the International Association of Machinists and requests them to accept same by affixing their official signature and notify them that this association is ready to sign the agreement jointly with them."

The meeting adjourned without further action on either side. The International Association of Machinists, through their officers, claim that the strike will now be extended throughout the country, and that strikes will be called in various cities, one after another, as soon as organizers can get around to them. They claim to control a very large proportion of the machinists of the country, through membership in the various local lodges, and that many other machinists, not at present affiliated with the organization, are in sympathy with the movement, and will assist in the strikes. The machinery manufacturers make no claims, but assert that they will continue to run their shops, with whatever labor they can get, making no discrimination whatever between union or non-union labor, or as to whether men have been previously employed by other manufacturers or not. They assert, however, that the machinists' unions will never be recognized, but that all shops will run non-union so far as the relations of the men to the employers are concerned. It is said that at first strikes will only be called in shops manufacturing mining, pumping, electrical and printing machinery, and that railroads, and large corporations, such as the large Chicago agricultural implement manufacturers, will not be interfered with.

Mr. Carnegie Favors a Barge Canal.

At the recent dinner given by the commercial organizations of New York in honor of Governor Roosevelt for his stand in improving the Erie canal the following letter was read from Andrew Carnegie:

"The point on which you deserve most credit, in my opinion, is that you stand for a barge canal as against a ship canal. Our experience of lake transportation—the carrying of 7,000 tons of ore in big ships on the lake, and its transfer at the dock into cars, or into barges—is decidedly in favor of the transfer into barges from the big ship, as compared with the great ship crawling through any possible canal. The cost of transfer, under new and improved conditions, is so small that it far more than compensates for the difference in cost with the cheap barge manned by a few men and a monster costly ship with its full crew, and the question may be considered settled.

"That your committee should have pushed aside the more attractive popular idea of the big ship canal and reached the true solution shows how carefully it has done its work. Your committee is to be congratulated again for going far enough and not too far. To spend money upon the present plans for a canal would be a mere waste, while to spend the sum you name for a thousand ton barge canal is, in my opinon, essential, if New York is to maintain her relative position. The recent purchases of railway stocks of the trunk lines by the two more prominent lines, thus ensuring mutuality of interest, must inevitably work against New York and in favor of the shorter rail line to tidewater at Newport News, Baltimore and Philadelphia. More than ever New York needs water transport to attract her share."

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

The "Baby Bessemer" Process. [*Zeitschrift des Vereins Deutscher Ingenieure*, Feb. 3.]—It will be remembered that not a great while ago strong efforts were made by interested parties to introduce into this country two French applications of the Bessemer process for making small steel castings. So far the results have not been very brilliant, for one process—the best one by the way—seems to be dead, and the other has to contend with troubles of a kind peculiarly inherent to the American demand for success under adverse circumstances. Be it noted that the processes themselves, if completely carried out, give a uniform and good grade of steel castings, but—and here is the difficulty—they are not carried out as they should be, not even in France, as the tests made by the reviewer on the product have amply shown him. What can we expect from the American demand for tonnage made by cheap men under ordinary foundry management with processes involving the loss of about 17 per cent of the iron charged during the blow? No wonder that in this country the open-hearth steel process is rapidly encroaching on the field formerly covered by the Bessemer only. As the "baby Bessemer" processes are rapidly extending in Europe, however, possibly because they get a high price for the castings, the article to be discussed may be of interest.

From the historical standpoint it sems that the first attempt to make steel castings by the Bessemer process was made in Upper Silesia in the early seventies, thin steel plates for street paving purposes being cast direct from the converter. The process did not take in Germany until 1890, when the works at Haagen bought the rights for the Walrand Legenisel process in Germany, and in 1896 licensed Mr. Carl Rott, of Halle, to undertake the production of Bessemer steel castings. Mr. Rott is the author of the article under consideration. England, Sweden, Russia and Austria and especially France, went into the baby Bessemer industry with vigor. The process of Robert makes use of a side blast. Tropenas blows the air on top of the bath, while Walrand uses the ordinary bottom blast and much smaller charges than the others. At Halle, where the Walrand-Legenisel process is used, they have a converter in which about 800-pound charges are blown at a time. The iron, melted in a cupola near by, is run directly into the converter by means of an extension to the spout. The composition of the pig iron is as follows: Silicon, 2.3 per cent; carbon, 3.5 per cent; manganese, 0.8 per cent; phosphorus, 0.07 per cent. Ten per cent scrap from previous casts is added and the melting ratio is 1 to 12½. Before the first charge is blown the converter is heated up with some coke burned under a light blast, then cleaned out and at once put into service. The process itself is interesting from the chemical standpoint, for the burning out of the silicon, manganese and carbon is to some extent regulated by the temperature of the bath attained. The iron from the cupola arrives at about 2,300 degrees F. and the conversion must raise this to about 3,100 degrees F. Now neither carbon nor manganese will furnish the fuel for this high temperature, but silicon does, every per cent of silicon thus burned being equivalent to a rise in temperature in the bath of over 500 degrees F. As the temperature gradually rises the point is reached (2,550 degrees F.) at which carbon will combine with oxygen before the silicon can get it, and hence the silicon will not go quite so fast while the carbon is reduced very rapidly. The German, English and Swedish adaptations of the Bessemer process are based upon this phenomenon. Thus the German pig irons being fairly high in silicon, there is consequently a very high temperature in the converter. The burning out of silicon practically ceases at 2,550 degrees F. The carbon now burns out, leaving about .30 silicon in the bath. Ferro-manganese being now added, the after-blow brings the bath to the proper composition and temperature for casting. The German process of Bessemerizing is therefore characterized by the high initial temperature and the recarburisation.

The English process deals with irons much higher in silicon and manganese, hence it is possible to blow with an initial temperature much lower than the German. Nearly all the silicon and manganese is burnt out in the first six minutes, the carbon now goes and with it the balance of the silicon, for the burning of the carbon tends to lower the heat of the bath slightly. In 12 minutes the 3.75 to 4.00 per cent of carbon is gone, and spiegel is added to get the proper composition. In the Swedish process the irons are so low in silicon that it must come from the cupola very hot. The burning of the silicon is just sufficient to reach the point at which the carbon can go, and not enough to allow recarburization. It is therefore necessary to stop the process at the exact carbon contents and cast at once.

In the application of the Bessemer process for small steel castings it is necessary to get a very high casting temperature and hence Walrand adds 5 to 10 per cent of melted ferro-silicon to the bath after the carbon is gone. An after-blow, lasting about one minute, is given, and then the final ⅗ per cent of ferro-manganese is added. The addition of the ferro-silicon and the after-blow results in a very high casting temperature. The addition of ferro-manganese results in a boiling up of the mass of steel, which subsides as soon as the reaction has taken place. Right here will be found the success or failure of the blow. There being little time to spare before the cast must be made (in the O. H. the metal should be in proper shape when tapped), it is difficult to get rid of the gases completely. A test is made as soon as the bath is quiet, by pouring some of the steel into a small ingot mold. If the metal solidifies and sinks it is in proper condition; if it boils over there is too much gas left in it, and more silicon, manganese or aluminum must be added. As this is often too late the result is a mis cast, which goes to profit and loss.

Mr. Rott now gives some recipes for making the molds, among which are the following: (a) 5 parts ground crucibles, 1 part clay; (b) 6 parts ground fire brick (Schamotte), 4 parts molding sand, 4 parts river sand, 2 parts clay; (c) 8 parts river sand, 1 part ground coke, 2 parts ground fire brick, 2 parts clay; (d) 6 parts ground fire brick, 6 parts river sand, 2 parts ground coke, 3 parts calcined clay, 2 parts raw clay. The material is ground fine, well mixed and sifted. It is now spread in thin layers, dampened, and let stand 24 hours. It will now ball properly and can be used at once, preferably as a facing, old material filling up the balance of the mold. The molds must be well vented and properly arranged for casting, the idea being to distribute the fluid steel as quickly as possible, so that sound castings may be the result. A layer of fire clay and graphite is now dusted on and slicked off, the molds are dried carefully and while still hot coated with a wash of ground quartz in molasess water. Green sand castings are made in molds rammed up with sharp sand mixed with a little coal tar. Great trouble is experienced from the presence of water in the blast; this got so serious that just as the carbon burnt out great flames issued from the converter; and a burned, gassy, and weak steel resulted. After settling tanks and screens were provided this evil ceased to cause any trouble. Mr. Rott seems to have had trouble with his cupola, the iron chilling too quickly. Hetherefore suggests the addition of a hearth so that it can be kept hot for a long time by a species of refining. Finally Mr. Rott gives some costs which will interest us sufficiently to be given in full. A day's run of five blows of 770 pounds each, or 3,850 pounds, gave a net weight of castings amounting to 1,760 pounds. These castings cost:

For labor—	
Melting,	$ 2.40
Converting	1.60
Molds and cores,	23.90
Cleaning,	6.00
Labor,	3.10
	$37.00
For Materia'—	
Pig iron,	$17.36
Ferro-silicon,	3.16
Ferro-manganese,	2.54
Fuel,	6.20
Supplies,	4.44
Shop cost,	11.00
	$44.70

This on a basis of 17 per cent lost of pig iron, 6 per cent lost of ferro-silicon and 3 per cent lost of ferro-amnganese, pig iron costing $19 10 per ton. The total cost was therefore $81.70, or 4.65c a pound. The castings weighing from ½-pound to 23 pounds each, brought 6.82 cents a pound and over in the market, figures that are certainly of interest to us. Mr. Rott now enumerates the advantages of the baby Bessemer process over the open-hearth methods, which, however, count for little with us here, as we are not over fond of the Bessemer products anyhow, and concludes that a great future stands before this branch of the manufacture of steel castings.

REGENERATIVE BOILER FURNACE.

E. M. Butz, civil engineer, a member of the firm of E. M. Butz & Co., Pittsburg, has been granted letters patent on a gas furnace for steam boilers. The object of the invention is to provide simple, inexpensive and effective means for applying heat derived from the combustion of producer, furnace, or other gas in the generation of steam in a boiler. The general adoption of the furnace in cities in which the smoke evil has become a bane, would result, in the opinion of the inventor, in solution of the problem, as no smoke whatever is emitted by the consumption of the fuel.

The boiler setting incloses two combustion chambers, each adopted to contain a portion of the boiler. A partition wall is interposed between the combustion chamber and a passage through the wall provides for the traverse of products of combustion from one combustion chamber to the other. There

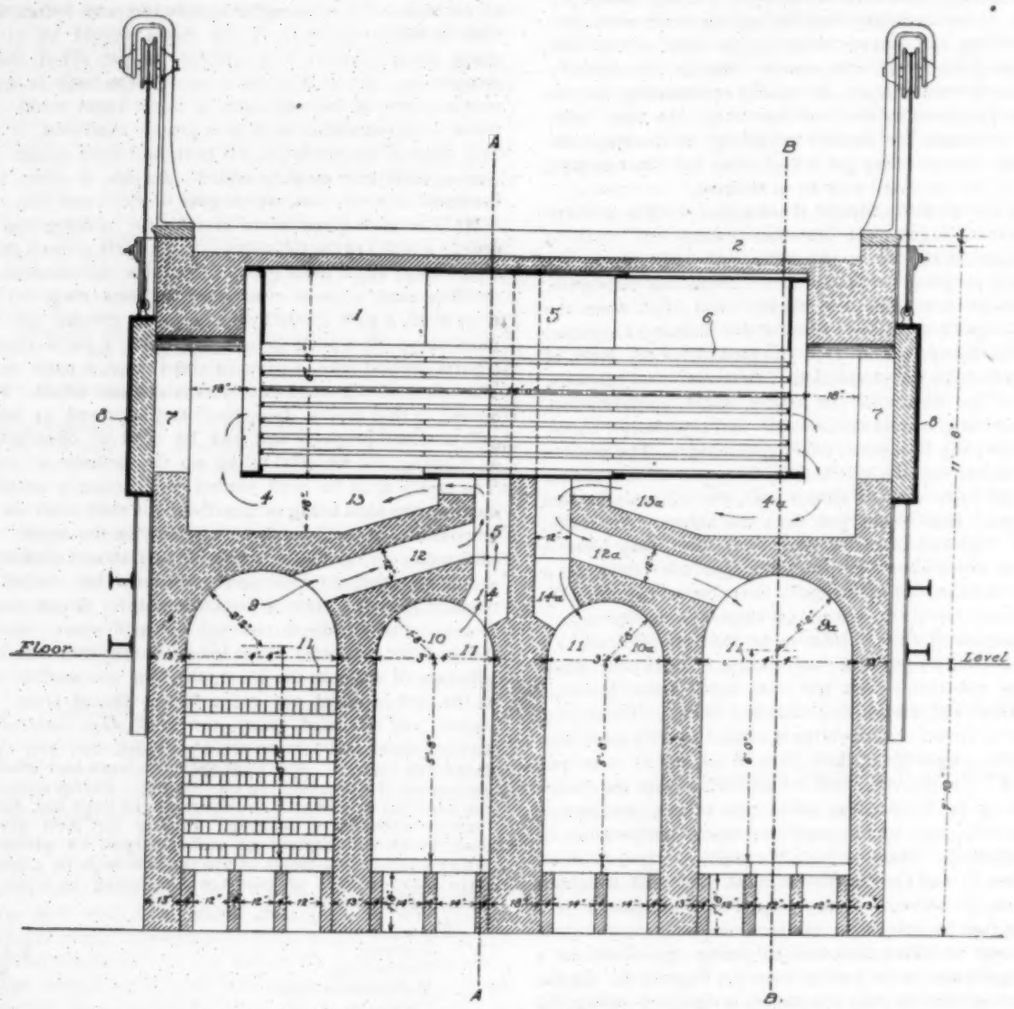


FIG. 1.—BUTZ REGENERATIVE BOILER FURNACE. LONGITUDINAL SECTION.

are two iegenerator chambers and passages, each connecting one of the regenerator chambers with one of the combustion chambers at points adjacent to the wall. The passage through the partition wall may be through the boiler, if desired, and this construction is shown in the drawings presented, but a separate opening outside of the boiler may be provided.

Fig. 1 is a vertical longitudinal central section through one pair of steam boilers of the horizontal tubular type and a gas furnace; Fig. 2 is a transverse section at the line xx of Fig. 1. It will be seen that the boilers are supported in a setting of brick work 2, which is divided by a longitudinal partition wall 3, into two independent furnaces, one for each boiler. The furnaces are similar in all particulars. The space within the walls of the furnace proper constitutes two combustion chambers 4, 4a, each of which surrounds and contains the major portions of the shell of the boiler nearly up to the water line and throughout nearly one-half its length, the only part of the length of the boiler in which it is not open to the combustion chambers being that occupied by a central transverse partition wall 5, which separates the combustion chambers one from the other at their inner ends. An avenue for the traverse of products of combustion in either direction from one combustion chamber to the other is provided by the tubes 6 of the boiler, and access is afforded to the combustion chambers for purposes of cleaning and repair or renewal of the boiler tubes by openings 7 in the end walls of the setting, which are closed by movable doors 8, having a lining of refractory material.

Air regenerator chambers 9, 9a are built in the setting below the combustion chambers and in cases in which it is desirable to reheat the gas as well as the air, gas regenerator chambers 10, 10a are located adjacent to the air regenerator chambers. The regenerator chambers are provided with brick checker work 11 in the usual manner. Ports 12, 12a lead upward from the air regenerator chambers on opposite sides of the central partition wall 5, and communicate with the combustion chambers 4, 4a, by passages 13, 13a, surrounding the lower portion of the shell of the boiler at the inner ends of the chambers 4, 4a, respectively. When gas regenerator chambers 10, 10a are likewise employed, they are connected with the combustion chamber passages 13, 13a by passages 14, 14a. Air is admitted to the regenerator chambers 9 and 9a alternately, and gas from a producer or other suitable source of supply is admitted to the passages 14 and 14a, alternately, or to the gas regenerator chambers 10 and 10a, when the same are employed, through pipes controlled by reversing valves.

In the operation of a steam boiler furnace of the construction substantially as above described a mixture of gas and air in proper proportions is delivered from the passages, as 14

and 12, leading to the passages 13, of one of the combustion chambers, as 4, and is ignited at the passage and burned in the combustion chamber, the heat generated is applied preliminarily to that portion of the boiler shell which is contained in the combustion chamber. The heated products of combustion pass through the tubes 6 into the opposite combustion chamber 4a and thence through the passages 13a, 12a and 14a, into and through the regenerator chambers 9a and 10a. After their traverse through the chambers has been continued for a sufficient time to heat thoroughly the checker work, the direction of supply is changed by manipulation of the reversing valves, and gas and air are admitted to and are burned in the combustion chamber 4a, being previously heated by their passage through the heated checker work of the regenerator chambers 10a and 9a. The products of combustion pass through the tubes into the opposite combustion chamber 4, and thence into the regenerator chambers 9 and 10 to the checker work, to which they impart their heat in

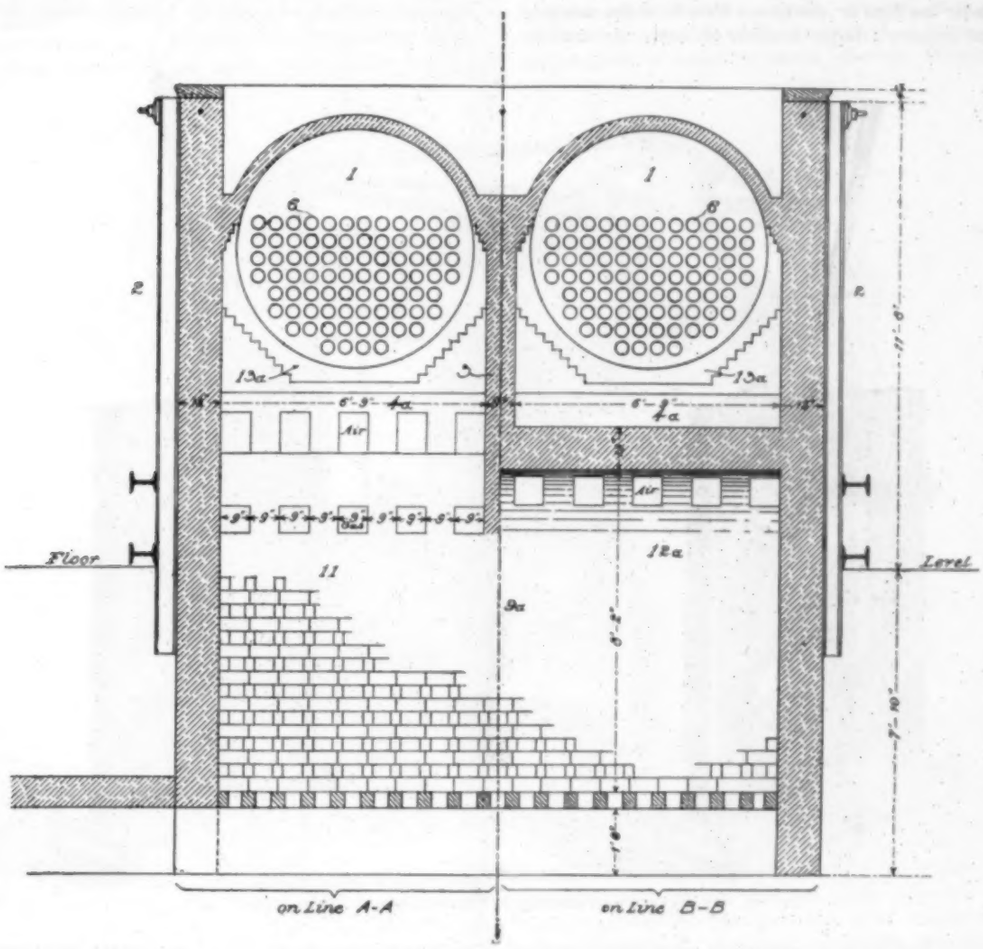


FIG. 2.—BUTZ BOILER FURNACE, CROSS SECTION.

their passage to the discharge flue. The direction of gas and air supply is changed after the chambers 9 and 10 have been sufficiently heated, and air and gas passed through them, heated, and delivered to the combustion chamber 4. The alternation of direction of supply and delivery of gas and air and products of combustion is continued similarly during the operation of the furnace.

Various structural modifications of the invention may be made in accordance with the requirements of the special forms of boilers in connection with which it is employed. It will also be seen that the gas regenerator chambers may be omitted when the gaseous fuel employed is of such a character that it is not deemed necessary or desirable to heat it before its admission to the combustion chambers. Therefore the invention is not limited to a construction of which gas generator chambers independent of and separate from the air generator chambers constitute elements.

The Tin Plate Market.

So far as the canning trade is concerned the market is at a standstill, the position of the canned goods trade causing a halt. There is delay in the completion of the can consolidation. Dealers report a better demand for plates, however, from the retail trade. The American Tin Plate Co. is reported well booked with orders for the next two months with fair orders reaching to July 1, and the present output is probably at the greatest rate in the history of the trade. Prices for 14x20 (100 lb.) coke tins are unchanged at $4.70 to $4.75, at mill, for March and April and $4.65 from May, June and July.

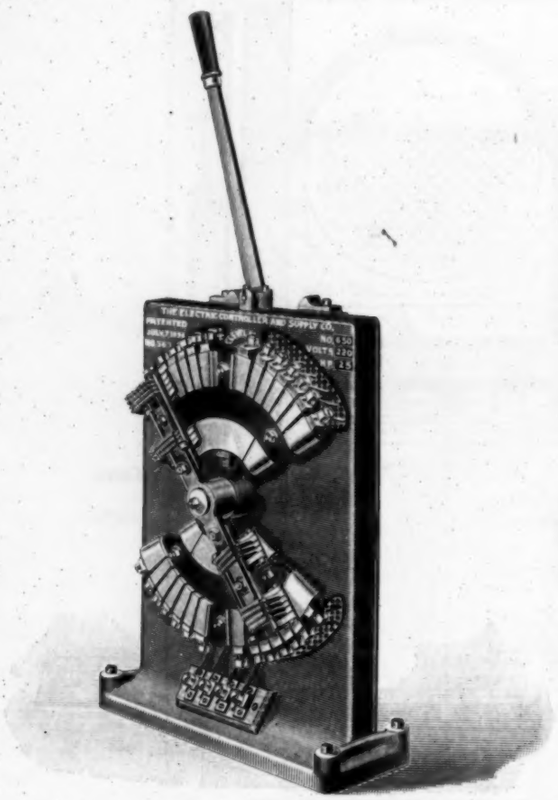
Chain Works Consolidation Formed.

At a meeting held in New York last week the organization of the Standard Chain Co. was perfected, officers and directors being elected. Nine of the principal chain manufacturing plants of the country are included in the combination, controlling 70 per cent of the machine-made chain output. The capitalization is $3,000,000 and in addition there is an authorized bond issue of $700,000. The constituent concerns are: P. Hayden Saddlery Hardware Co., including rolling mills, Columbus, O., Franz Krein Mfg. Co., Marion, Ind.; Fran Krein Chain Co., St. Mary's, O.; Baker Chain & Wagon Iron Mfg. Co., Allegheny, Pa.; Garland Chain Co., Rankin Station, Pa. Dower & Mallery, Carlisle, Pa.; John C. Schmidt & Co., York, Pa.; Nes Chain Mfg. Co., York, Pa., and Lebanon Chain Works, Lebanon, Pa.

The following officers were elected: J. C. Schmidt, York, Pa., president; A. S. White, vice-president; J. T. Davis, of the Baker Chain & Wagon Iron Mfg. Co., Allegheny, general manager Robert Rigney, treasurer, and Robert Garland, Pittsburg, secretary and general sales agent. The directors are A. S. White, C. R. Flint, H. W. Oliver, J. C. Schmidt, Chas I. Nes, J. P. Davis, C. H. Hayden, Peter Werts, F. F. Culver, Franz Krein, Eli Attwood, Robert Garland, and L. Gubelman. The headquarters of the company will be in Pittsburg, offices having already been secured in the First National Bank Building, Fifth ave. and Wood st. The rooms are at present occupied by the American Steel Hoop Co., but will be vacated on April 1, upon the removal of the American Steel Hoop offices to the Empire Building. The Baker Co. is now building a large plant at Rankin, Pa., adjoining the Garland plant.

THE DINKEY STANDARD CONTROLLER.

In the installation of controllers for electric motors, it frequently occurs that only a limited amount of space is available, or, for some important reason, compactness of controller is of great advantage. A case in point is the installation of controllers in the Wellman-Seaver Engineering Co.'s overhead charging machine, of which a view is given below. In this machine four separate controllers are required to control as many distinct operations of the machine. It is important, therefore, to reduce to a minimum the space required for each controller. This requirement is met by the Dinkey standard controller, the dimensions of which are as follows: Base, 24x9 inches; height to top of frame, 32 inches; height to top of lever, 54 inches; width of controller at widest point, 11 inches. The Dinkey controller is made very substantial, t has great carrying capacity, and is easy to control. it is self-contained. The resistance boxes are contained in the machine, and there are no separate resistance boxes to be installed under the floor or elsewhere outside of the machine, which would require a large number of extra connections.



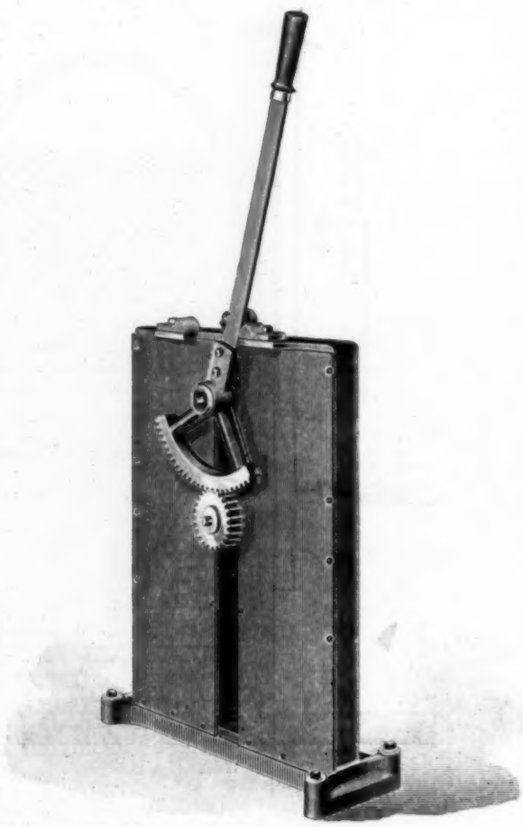


FIG. 1. FRONT VIEW—THE DINKEY CONTROLLER.—FIG. 2. REAR VIEW.

There are only four wires to connect in an entire controller, hence it can be quickly installed, removed or replaced. In case accident to the electrical equipment should cause the controller to burn out, the machine can readily be taken out, by disconnecting four terminals, and a duplicate machine slipped into place and connected without loss of time. There are no interior cables; every contact and connection is in plain view, and easy to get at. A single lever controls both the forward and backward motions of the machine, no reversing switch being required. When the lever is in a vertical position all current is shut off from the motor and the lever when in this position is securely held by a positive stop which prevents jarring on to the contact. The controller contains no combustible material, and is fireproof. It can be placed on the floor of building or cage, or can be inverted and anchored to the ceiling, as may be most convenient. Many of these controllers are in use in the United States, over 500 being in operation in the Carnegie Steel Works alone. They are also extensively used in large manufactories in Russia, Austria, England, Germany, Spain, South America, Canada and Mexico. The Electric Controller & Supply Co., Cleveland, is the manufacturer.

SILICON IN FERRO-SILICON.

BY FRED W. BAUER, JACKSON, O.

A sample of ferro-silicon which contained a very large amount of silicon, was recently sent to several well-known chemists for the determination of this element. The sample was pounded in a mortar (the hardening effect of the silicon itself being too great to allow drilling) until all passed through a very fine mesh sieve, after which it was cleaned, thoroughly mixed, and a small amount sent to each of the chemists represented below. The object was not to produce figures in support of chemical inaccuracy, but merely to obtain results from different sources, employing, as is shown below, different methods for determining this element, when existing in such an unusal quantity, as in this sample. This is a grade of iron not often met with by the chemist, and consequently no recognized method exists. It is needless to say that regular methods employed for silicon determinations in pig iron fail to give saitsfactory results, so that changes in standard methods and entirely different means are required when working with this material.

The writer does not intend to advance any comments upon the results, or the methods used in obtaining them, as they are simply presented for the purpose of inviting opinions from any who are interested. But in order to call attention especially to a few points, a brief summary will not be out of place. (1) With two exceptions each determination represented a distinct method. Where the same methods were employed the variation was not greater than .06 per cent. (2) The two methods (Nos. 1 and 2) employing volatization of silica produced the widest results, the difference in the methods being in the acids employed for solution. (3) Direct fusion of drillings (Nos. 6 and 8) in Na_2Co_3 gave comparatively higher results than fusion of residue from acid mixtures (Nos. 9 and 10), except No. 7, where HCl alone was used in dissolving. (4) The variation in results, obtained by using bromine for the oxidizing agent (Nos. 3 and 4) as compared with fusion in sodium peroxide is very small. The names of the different chemists are withheld, their wishes not having been consulted. A sample of this iron can be had by any who desire it. The results and methods follow:

1. Si, 16.68 pr cent. Volatilization of silica after evaporation in HCl and few drops of HNO_3.

2. Si, 16.21 per cent. Direct fusion in Na_2O_2 in nickel crucible.

3. Si, 16.19 per cent. Oxidation of silicon by bromine in HCl solution.

4. Si, 15 90 per cent. Same as No. 3, afterwards evaporation with silicon mixture.

5. Si, 15 80 per cent. No method reported.

6. Si, 15.75 per cent. Direct fusion with Na_2CO_3.

7. Si, 15.75 per cent. Fusion with Na_2CO_3 of residue from solution in HCl alone.

8 Si, 15 71 per cent. Same method as No. 6.

9 Si, 15.27 per cent. Fusion with Na_2CO_3 of residue from HCl and HNO_3.

10. Si, 15.21 per cent. Same method as No. 9.

11. Si, 14 90 per cent. Volatilization of silica after evaporation in HCl and H_2SO_4. HFl used in volatilization.

Probable Advances in Machinery Prices.

A representative of one of the largest American machine tool concerns refers in the *American Machinist* to an improving demand. Speaking of prices, he says that while they are now stationary, he expects to see further advances. This is because manufacturers for a long time were using iron and steel obtained under old contracts at low figures, but now they are feeling more keenly the strength of the material market. Advanced wages, such as are noted in the West, he believes, will also have an effect upon machinery prices.

A meeting of Cleveland manufacturers in the metal trades held in the past week resulted in the organization of the Manufacturers' Association of Cleveland. It is understood that a number of the members will affiliate with the national organization—the National Metal Trades Association—but one of the reasons for forming a local organization at the present time is the demand of the machinists' union for a nine hour day with 10 hours pay and for recognition of the union. At the initial meeting of the new association a resolution was unanimously adopted refusing the demand of the men in its present form.

A portion of the plant of the Pennsylvania Malleable Iron Co., at McKees Rocks, Pa., was put in operation this week.

ANNEALING MALLEABLE CAST IRON.

To the Editor:

In the recent paper on "Annealing Malleable Cast Iron," Mr. Davis shows that the iron gains from 3 to 6 per cent in weight. This he asserts is due to iron reduced from the packing and welded on to the iron casting. Dr. Moldenke criticises this and contends that the gain is due to oxygen and not to iron. To see if Dr. Moldenke's criticism was just, I selected a casting which gave signs of much oxidation and determined the oxygen and found seven-tenths of one per cent (.7 per cent) present. The average gain in weight of these castings is over 3 per cent and this small amount of oxygen does not account for the gain. It is true there is more or less oxygen with the iron on the surface of the castings. This sometimes forms a beautiful purple coating, but it is insignificant when compared with the gain in weight.

The conditions of annealing give every reason to believe that Mr. Davis is right in his assertion. First. The packing in use contains a large amount of minute iron pellets. These may be separated with a magnet. Second. Most of the oxide of iron in the packing is the lower oxide. Only 9 per cent of sesqui-oxide is found in much packing. Third. There is sufficient carbonic oxide produced by the oxidation of the carbon diffused to reduce the iron oxide. Fourth. The heat is ample to effect the reduction and weld the particles to the annealed casting. The heat conditions are very similar to the heat conditions in roasting ore with culm in kilns. At the red heat of the kiln much iron is reduced and large pellets of metallic iron are found in the roasted ore.

Apart from this distinct gain in weight due to the accretion of iron is the phenomenon of expansion, always remarkable in annealed iron. At the heat of the oven the dense white iron, having a specific gravity of 7 8, loses part of its carbon and nearly all the rest goes out of solution as graphite. An entirely new crystallization sets in and the casting expands like water in freezing. The iron now has the lower specific gravity of 7.6 showing spaces between the crystals; the graphite appearing in these spaces. If the anneal is carried further the graphite disappears and the annealed casting has many of the properties of wrought iron.

Our thanks are due Mr. Davis and Dr. Moldenke for calling our attention to this most common but most wonderful cast iron.

N. W. Shed.

Philadelphia, Pa., March 14.

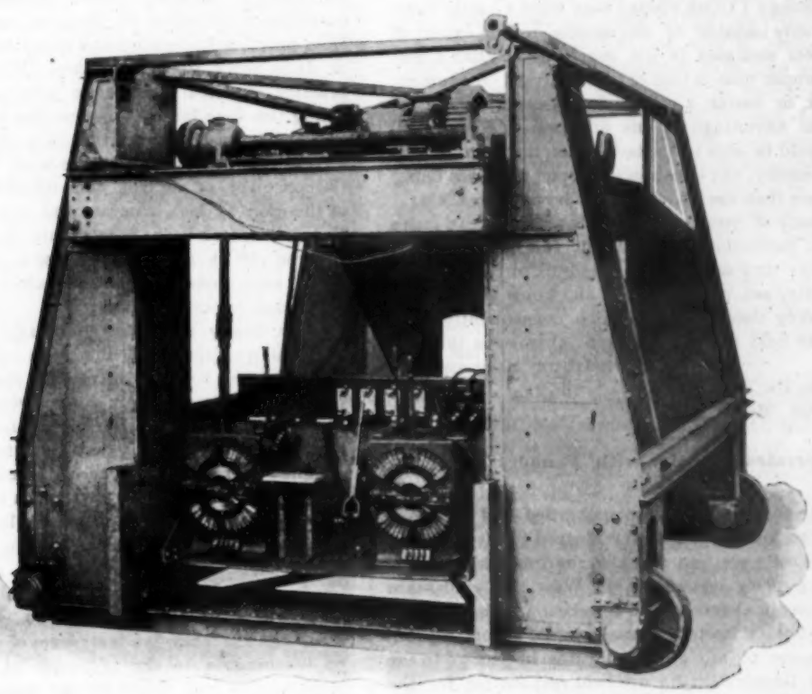


FIG. 3.—INSTALLATION OF DINKEY STANDARD CONTROLLERS IN THE WELLMAN-SEAVROVERHEAD CHARGING MACHINE.

THE CHEMIST AS A FOUNDRY FACTOR.

Should Have Control of the Mixtures.

To the Editor:

The duties of a chemist in the foundry depend on the man. If he be a chemist only in the sense of being able to make a few laboratory determinations, he might better stick to the laboratory, but if also a metallurgist, he should in my opinion be entrusted with control of the mixtures. It is a question of metallurgy and should be in the hands of a specialist in that line. Dr. Kirk's plan for the establishment in the mechanical schools of a practical course in the metallurgy of foundry practice is a good one. Those taking such a course would receive instruction which in their future work would enable them better to serve both their employers and themselves. R. S. MacPherran.

The Edward P. Allis Co.,
Milwaukee, Wis., March 12.

A Broad Field for the Intelligent Chemist.

To the Editor:

The question under discussion certainly is an important one from the manufacturer's point of view. My understanding of the term "chemist" is probably broader than usual in this country, although I think abroad they have a better idea. A man who is only capable or responisble to the extent of furnishing correct analyses is not much better than a machine, and his proper title is that of an analyst. A chemist, to be a chemist, or better, a chemical engineer, should be able to know the advantage of his analyses in commercial practice and should be able to curtail losses and correct mistakes in the foundry, the question of correct analyses being of less importance than the knowledge of how to use them.

There are plenty of young men obtainable who can make correct analyses, particularly of iron, but few who can use the analyses after they are made. The bulk of the foundrymen of this country are practical men and know a great deal more about molding than cupola practice, consequently there should be a broad field for the intelligent chemist in this line of work. Bertrand S. Summers.

Western Electric Co.,
Chicago, Ill., March 10.

Chemist Co-operates Closely with Foundry Foreman.

To The Editor:

In reference to the chemist's responsibilities and functions in connection with foundry work, am pleased to give you my opinion of Mr. West's position and also the one taken by Dr. Kirk. I cannot entirely agree with Mr. West, and will state just what position our chemists hold in relation to the cupolas. Analyses and physical tests are made in our laboratory, reports of which come to me and duplicates in part go to the foremen in the foundries, who are held responsible for the working of our cupolas, and to whom the chemists give the mixtures. So far we seem to coincide with Mr. West; but at this point we fall in with Dr. Kirk, and demand the assistance of our chemists in running the cupolas. All suggestions and orders, however, under which they take charge come from the foremen, and they are there only to assist them in carrying on their work. In this manner they become acquainted with practical foundry operations, know just how the coke, iron and flux are working, and with their chemical knowledge combined with the practiacl knowledge they have gained, or obtain from the foremen, we get we think the best results. Their presence in the foundry daily also brings them in touch with losses, bad castings, etc., in which they see the practical results and very frequently are of service in overcoming them. Chas. Bauer.

The Warder, Bushnell & Glessner Co.,
Springfield, O., March 10.

What Foundry Chemistry Properly Applied Will Do.

To the Editor:

In replying to your favor of the 7th inst., I would say that the subject upon which you invite an expression of opinion from me has been so fully and ably expounded several years ago, as well as recently, that anything I could say would be mere repetition. *The Iron Trade Review* covered this subject exhaustively six years ago, and at that time sent letters of inquiry to superintendents of foundries and others. In the issue of March 29th, 1894, of the *The Iron Trade Review*, a number of replies are printed. The letter signed by the manager of Wm. Sellers & Co., Inc., though brief, is very comprehensive, and answers your queries so fully that I would suggest that you reprint it at this time in this connection. The fact stated therein that metal having a tensile strength of over 30,000 pounds to the square inch, "easily machinable," was tapped, as a regular routine, from the same cupola from which pulleys and other small castings were poured "a little earlier in the heat" may be novel to some of your readers today.

During my connection with metallurgical work in foundries, extending over a period of almost a quarter of a century, I have seen, of course, some progress and many changes. Formerly crass ignorance of chemical or scientific principles involved in foundry metallurgy was general, now it appears in spots. I was once informed, many years ago, by a foundry superintendent that a certain brand of iron contained so much "ammonia" that he had been obliged to throw it out. Recently I have seen it stated in print that pig iron contains "magnesia."

We still have a good deal to learn, and perhaps as much to unlearn regarding cast iron. My own opinion is that there has been a tendency (natural enough) to bring into undue prominence the value of chemical analysis as a thing apart from practical knowledge and experience, gained by long years of daily work in the foundry. When properly applied in practice, chemical knowledge is valuable in the foundry, enabling the founder to produce, day after day, uniform mixtures, if desired, or metal of vastly varying characteristics, as it may be best suited to the work in hand. Furthermore, the consumer of pig iron thus fortified, becomes independent of the more or less accurate and always glowing representations of the iron brokers or agents of the furnaces producing the iron; he is able also to use a greater variety of brands and to save money in his purchases, while at the same time producing superior castings.

He is, finally, able to make castings "under guarantee as to physical qualities" and this is a matter of no small importance. As a single illustration I may recall the fact that in 1891 some immense gun lathes were made for the United States government. The largest lathe, designed by Wm. Sellers, Esq., for boring and turning 16-inch steel cannon, weighed over 250 tons. The main bed was 74 feet 10½ inches long, 9 feet wide, with an extension bed for carrying the boring arrangement 54 feet 5 inches long, 5 feet 2 inches wide. The live head was a massive casting as, indeed, were nearly all the parts. These castings were made under the eye of a government inspector who spent his whole time for a year at the works of William Sellers & Co., where the lathe was constructed. Seventy-five test pieces of cast iron were forwarded to Washington to the inspector of ordnance; these pieces were turned and pulled by the experts employed in the department of ordnance. Each test piece was marked with the name of the particular casting made from the metal. These tests proved to the satisfaction of the government officials the high quality of the metal and copies of the official records of the tests were courteously furnished to the writer by the inspector. These tensile tests were, of course, entirely distinct from the daily transverse tests made in the foundry, and they proved very interesting as corroborations of the foundry tests the average ratio of tensile or transverse strength being about 10 to 1. The metal varied in composition from ordinary soft foundry iron, used for pulleys, up to the strongest kind of cast iron that is readily machinable. Some of the tensile made in Washington approximated the figure mentioned in the letter of the manager of the works of Wm. Sellers & Co., Inc, to *The Iron Trade Review* in 1894.

A. E. Outerbridge, Jr.

Philadelphia, Pa., March 9.

Mr. West in Reply to Dr. Phillips.

To the Editor:

Dr. William B. Phillips in commenting on the discussion between Dr. Kirk and myself makes two statements which I would like to say a few words upon. In his first paragraph the Doctor says: "I am an advocate of chemical grading but I have often been astonished to see how close an experienced

grader can and does come to grade, as established by analyses. My experience has been that this approximation to the analyses is much closer in respect of silicon than in respect either of sulphur or carbon." If there is any correct principle to guide a grader, why should he be right one time and wrong another? I am surrounded with blast furnaces and have not only seen several hundred thousand tons of pig metal together as noted by the Doctor, but have seen acres upon acres, almost a county, one might say, of piled pig metal. And a great deal of it I have gone over with furnace managers and shipping clerks, having their records along with them, to show what silicon, etc., was in the iron of each pile. With the Doctor I can say that some of the piles closely looked the grade as "established by analyses." But let me ask the Doctor if he would risk any money on the belief that experts at grading could go through a big yard and not make a miss at guessing the silicon contents of any of the piles. If the principle of grading is correct, or one that a founder should have any faith in, the grader should not make a miss with even one pile. It is natural to expect that if there are say, a dozen different piles or "casts" some of them will closely resemble the analyses in their fracture indications. Hence as in a lottery of blanks and prizes the grader must "hit" it once in a while. And this is all there is to cause any one to be astonished at seeing how close a grader may come to the grade as established by analyses. I think a little thought on the above line will give convincing proof that expert work in grading by fracture is a farce, or might be called a grand lottery; with chances of "hit" and "miss" that make the consumer the sufferer.

Further down the Doctor says: "I do not for a moment suppose that Mr. West would dispense with a close visual inspection of his iron." The Doctor may be surprised at my saying that though we use fully 80 tons of pig iron at every "heat," I never bother my head with considering the looks of the fracture, as I know from experience that this would be time wasted. All I want to know is that I have a correct analysis; and to make sure of this we have our chemist check the furnace analysis of every car of iron we use. If the first sampling of a car does not agree fairly with that reported by the furnace, we take a second sample and then will be guided by the average of the two. As one example of many, I have seen iron reported by furnace analyses to be about 2.50 in silicon, while two checkings showed that it only went about .60 in silicon. Had we been guided wholly by furnace analysis, we would have lost a whole "heat" of about 80 tons of castings.

Not long ago a founder holding the same opinion as Dr. Phillips called upon me and, supposing I always inspected my irons, asked me to go with him to inspect a car of iron a furnaceman had sent him, to put into a job lot of hot blast pipes. The founder said the iron did not look good enough to put into sash weights. The first question I asked was if he knew the analysis. He said the furnace had reported about 2.25 in silicon and .025 in sulphur. I surprised this man by telling him it would be useless for me to see his iron, as I could not tell anything by its looks. I showed him some samples in our office, to illustrate how what he might think to be worthless iron was excellent and what he would think to be fine iron by its fracture, would when remelted prove the contrary. I told this man to select six samples from his car, take drillings and have them analyzed and if they agreed closely with the furnace analysis to go ahead and use the iron and that I would pay all damages if the casting did not come out all O. K. providing he ran his cupola in his regular way. The next time I saw this founder he had to tell me that the iron proved all right. This is only one case of many that might be cited to show how all foundries can expect losses and trouble where they are guided by appearance of fracture instead of correct chemical analysis.

THOS. D. WEST.

Sharpsville, Pa., March 10.

THE plant of the Mesta Machine Co., West Homestead, Pa., was placed in full operation last week, the last of the departments, the finishing shop, being started. All the work in the South Side plant, Pittsburg, has been stopped, and the men are now employed in West Homestead. This plant was formerly the Robinson-Rea works.

THE GERMAN IRON MARKET.

TO THE EDITOR:

It is already well known that there is a shortage of pig iron on the European continent and especially in the German Customs Union or Zollverein. Though the production of pig iron in the German Customs Union, that is the states of the German Empire and the Grand Duchy of Luxemburg, in 1899 exceeded 8,000,000 tons, it was necessary to import about 750,000 tons to meet the requirements. Of this amount 500,000 tons came from Great Britain and only about 30,000 tons from the United States. The rest came from European countries like France, Belgium, Austria and Sweden. In spite of this enormous consumption for a country like the German Empire, relatively small compared with the United States, it may be of some interest to the iron producers and consumers in this country to know that the German production is now falling off, while the consumption is still increasing. The production in January was 6,000 tons less than in December last, and in February it lessened further.

In the last half of February the selling offices of the pig iron syndicates invited the pig iron consumers to state their requirements for the next year (1901) so that the needed tonnage might be produced, or, if there would be a shortage, to divide the available iron proportionately among the consumers. Subsequently it came to light that there will be even a more marked shortage of pig iron in Germany in 1901; and thus all the probable production up to June 30, 1901, is already sold, the contracts being closed at prices which exceed expectation. The Verein für den Verkauf von Siegerlaender Roheisen has fixed the price for next year's deliveries for spiegel-iron with 10 to 12 per cent manganese at 110 marks ($27) per metric ton of 1,000 kilos, equivalent to 2,204 pounds, avoirdupois. For deliveries in the current year this kind of iron was sold for the most part at 72 marks, or $17, and a smaller tonnage at 85 marks, or $20. The above mentioned price means, therefore, an advance of from 25 to 38 marks, or $6 to $9 per ton. The price for finished material is likewise greatly advanced. The price for gas pipes has advanced since March 1, the syndicate having lowered the discount for heavy pipes to 57½ per cent and for galvanized pipes to 46½ per cent. The patent welded tubes are also higher in price.

It appears from the above that the German consumers buy iron for the remote future at prices of which they never dreamed. And as the German manufacturers generally know far ahead what they are going to do it is to be expected that prosperity will prevail in the iron and steel industry for at least the next 18 to 24 months. It makes no difference if prices in the United States drop a few dollars, when the world consumption keeps on. Europe with its 25,000,000 tons production of pig iron in 1899 was compelled to buy American raw and half-finished and finished material in increasing quantities, and it will be the same in 1900 and in 1901, until American manufacturers at length find ways and means to have sufficient material when it is needed and where it is needed. One way would be to establish stores of supplies of pig iron, plates, sheets beams, tees, bands, hoops, pipes, etc., along the rivers Rhine and Elbe—for instance in Rotterdam, Köln, Frankfort-on-the-Main, Mannheim, and Strassburg in Alsace, for the Netherlandish, West and South German and Swiss trades, and in Hamburg, Berlin, and Magdeburg, for the countries depending on the trade of those cities. With the opening of lake navigation and the Welland Canal there will be an opportunity to run steamers from lake ports direct to Rotterdam, and there would be freight enough on hand on either side when the iron and steel manufacturers of the Central West use their abilities and influence to accomplish what everybody who studies world commerce and the movement in the iron trade must regard as in the natural order of things.

J. M.

THE Berlin Iron Bridge Co., of East Berlin, Conn., has increased its capital stock to $750,000 and made extensive purchases of land at Pittsburg, where it will start a branch. The company has placed the orders for the greater portion of the machinery equipment and is now at work on the plans for the buildings, which will be quite extensive, designed and built by the company at its own shops. It is intended that this plant shall be fully equipped with all modern appliances for doing all classes of steel bridges and structural work.

BALANCING BAILERS FOR UNWATERING MINES.*

BY WILLIAM KELLY.

The simplest and most effective way to balance bailers in a shaft with two compartments is to attach them to a hoisting plant of which the rope winding part is driven directly by a pair of reversible engines. There are a number of "first motion plants" that fill the requirements in the Lake Superior district but they are not always available when bailing is required. Orders for unwatering mines and emergencies in pumping usually come with little warning and appliances at hand must be utilized. The advantage of balancing bailers is so great that it is desirable to use some device for the purpose even when a direct acting plant with reversible engines is not at hand. We have lately had some experience in unwatering mines and the methods adopted for balancing the bailers may be of interest.

Some years ago two bailers were made for the West Vulcan mine to be used should an emergency arise and as there is a "first motion plant" there, the weight of the bailers was a secondary consideration and they were made of ¼-inch steel. The bailers were not used until it became necessary to unwater the Curry mine in the early part of 1899. The hoisting plant consists of two 6-foot independent drums on a shaft driven by a non reversing Corliss engine. The safe load for the plant was given by the buidlers as 8,000 pounds. The shaft has two compartments. The plan adopted for balancing the bailers was counterbalancing each bailer separately. To determine the size of the bailers and the quantity of water that could be raised at a lift, it was necessary to deduct from the safe load for the engine the

Weight of 600 ft. ot 1-inch rope, at 1.58 lbs., ...	948 lbs.
Weight of 600 ft. of ⅝-inch rope, at .62 lbs., ...	372 lbs.
Weight of bailers unbalanced to overhaul rope to engine house, ...	300 lbs.
Total, ...	1 620 lbs.

leaving the amount of water load 6,380 pounds. This is equivalent to about 765 gallons, and as the bailers are 39 inches in diameter they were made 12 feet 4 inches in length above the valve. The counterbalances used were 12-inch Cornish pump plungers. Scrap was put inside and the weight adjusted so as to counterbalance the bailers except so far as was necessary to allow them to start down freely from the top. The advantage of this plan is that the bailer that is at the bottom may be started just as the upper one gets to the dump and while one is being raised the other one is emptied and lowered into the water, thus saving the time it takes for emptying and filling and keeping the engine hoisting continuously. The disadvantage of the plan is that where provision has not been previously made, a road for the counterbalance has to be put in as unwatering proceeds, a matter which takes considerable time.

Just as unwatering at Curry was nearly completed another plan for balancing bailers was suggested and seemed to offer considerable advantages, so when it was decided to unwater the East Vulcan mine the new plan was tried. The hoisting plant at East Vulcan consists of two 10-foot drums in tandem driven by a non-reversible Corliss engine. The bailers were balanced by means of a third rope running from one bailer up over a pair of head sheaves and down to the other bailer. The feasibility of the plan depended on whether the brake of the drum of the descending bailer could be eased off so as to throw the weight of the bailer upon the counterbalance rope and yet permit the hoisting rope to get too much slack. The brakesman thought this could be done. It was found in practice, however, that the brakesmen were unable to keep the two drums so nearly at the same speed and the weight of the descending drum was thrown suddenly from the drum rope to the counterbalance rope and back again with the result that in a few hours the counterbalance rope was broken.

The capacity of the hoisting engine as figured by the makers is a little over 15,000 pounds. One and one-eighth inch ropes are on the drums for which the safe working load is 16,400 pounds. The counterbalance rope is ⅝ inch, for which the limit is 5,400 pounds. The weight of 880 feet of 1⅛-inch and ⅝-inch rope is 2,300 pounds, which deducted from the capacity of the plant, gave us 12,500 pounds as a safe load of water. The bailers were lengthened so as to be 24 feet 4 inches above the bottom of the valve and being 3 feet 3 inches in diameter, held a little over 1,500 gallons. They weighed empty, one of them 5,250 pounds, the other 5,400 pounds.

When it was found that the counterbalancing rope from one bailer to the other was an unsatisfactory arrangement, the following plans were open: First, to take out one bailer and use the compartment for a counterbalance, so as to continue the use of a bailer of full size. The size of the hoisting department did not permit of putting in a counterbalance for a bailer in the same compartment. The second plan was to cut down the bailer so as to bring the weight of the bailer and load within the capacity of the engine. This would reduce the weight of water hoisted per load nearly one-third. A third plan was to run the bailers as they were without any counterbalancing device and take the chances on the machinery, but the load was one-third more than recommended by the makers of the machine, and the idea did not commend itself. A fourth plan was devised, and to study its feasibility a model was made by Mr. Roberts and this was used to illustrate the topic in presenting it to the institute. The device adopted consisted of a third rope the ends of which are wound upon the two drums in the reverse direction from that of the hoisting ropes to permit of the traverse upon the drums; the rope instead of going directly from one drum to the other is carried about 200 feet to a turn sheave, as illustrated by the photograph of the model. The mode of operation is as follows: When the bailer gets to the top, the brakesman sets the brake, and at the same time the brakesman at the other drum sets the brake for the bailer that is in the water. As soon as the bailer at the top is empty, which takes about 12 to 15 seconds, the brakesman releases the brake of the upper bailer and its weigt is carried by the intermediate rope to the other drum tending to wind the latter up. The second brakesman then releases the brake and puts on the friction and hoists the lower bailer of the top. It has worked quite successfully.

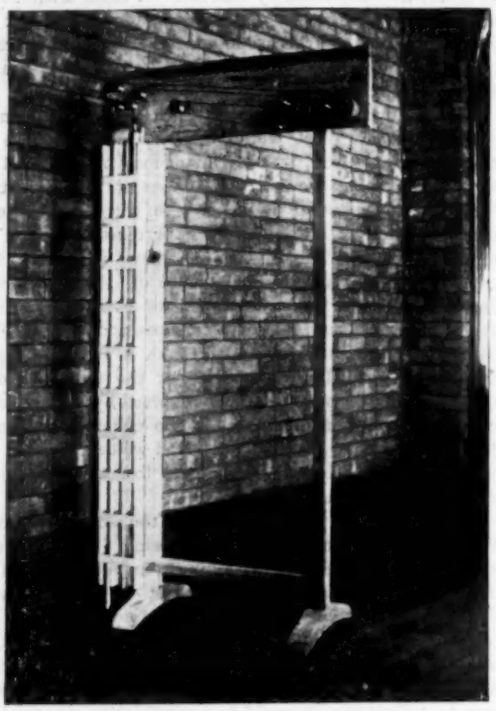


FIG. 1 —A MODEL USED TO ILLUSTRATE THE SYSTEM OF BALANCED BAILERS AT EAST VULCAN MINE.

*Read before the Lake Superior Mining Institute, Iron Mountain, Mich., February, 1900.

GEORGE MEGREW, one of the defendants named in H. C. Frick's bill in equity against the Carnegie Steel Co., Ltd., and others, filed his separate answer at Pittsburg last week. He says that he is the owner of 1-9 of 1 per cent of the capital stock of the Carnegie Steel Co., and adds that he knows nothing of any of the differences existing between Andrew Carnegie and Mr. Frick.

UNIVERSAL RADIAL DRILL WITH 4 1-2 FOOT ARM.

The four-and-one-half-foot universal radial drill of the Wm. H. Warren Machine Tool Works, of Worcester, Mass., and New York City, is now built with overhead drive as shown in the illustration below. Three other sizes of the same type of machine are made, namely, with 5½ foot, 6½-foot and 8-foot arms. The back gearing is placed on the spindle and the arm travels on a revolving column which is separate from the main column and rests on 18 ⅞-inch steel balls. This form of construction increases the strength of machine and makes it handy to operate. A special feature is the use of the spindle for floor boring. It can be swiveled until parallel with the base plate, and as the arm can be lowered until the spindle is within 24 inches of the base plate, heavy pieces can be placed at the side of the drill, and drilled and bored at a very low point. The balance weight is guided, and requires no adjustment to the horizontal position of the spindle. The

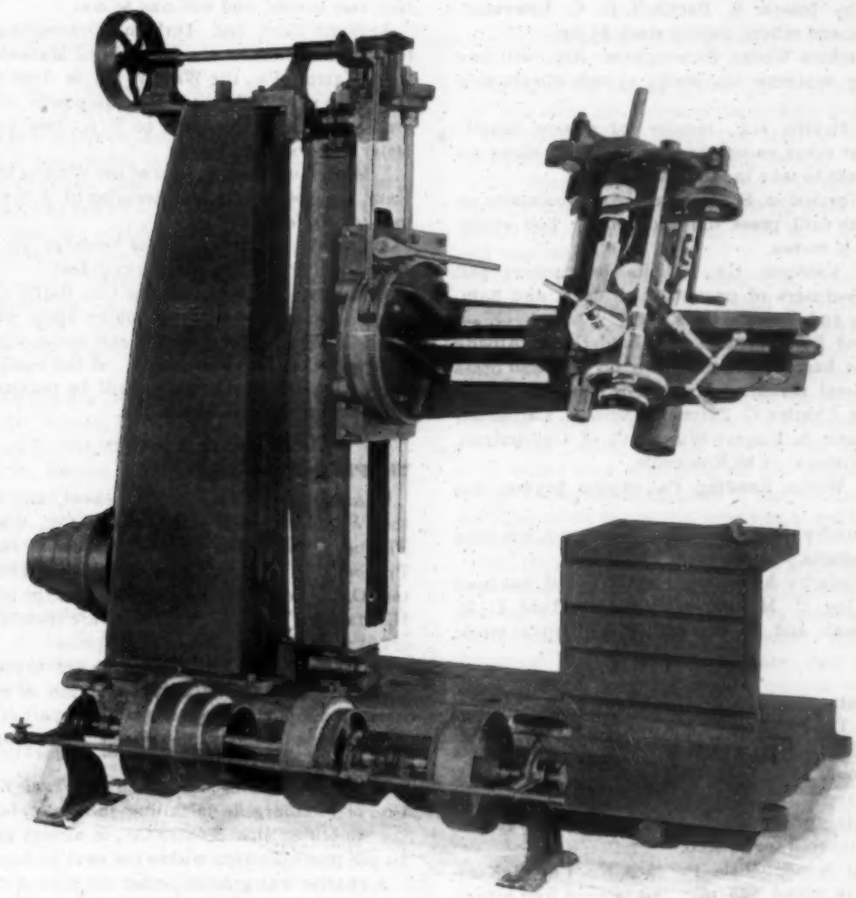


FIG. 1.—FOUR-AND ONE-HALF-FT. UNIVERSAL RADIAL DRILL.

entire quick return and feed are the same in all positions.

The base plate is a heavy casting 7 inches thick, 103 inches long, and 47¾ inches wide. Four accurately planed T slots run the length of the working surface. The table is 27 inches long, 26 inches wide and 24 inches high. Two sides of the table have milled T slots running the entire length, and provision is made to bolt the table at any position on the base plate. The arm can be swiveled to any angle by the worm gear shown, which is cut around the entire circle. It has a vertical adjustment of 42 inches, and is raised and lowered by power. The spindle is 1 15-16 inches diameter above the sleeve, and in the sleeve is 2¼ inches diameter. It has a traverse of 16 inches, and the back gearing is so arranged that the speed can be changed instantly, to accommodate drill, reamer, counterbore or tap. The feed cone has three steps. The spindle is bored to fit a No. 4 Morse taper. The greatest distance from the face of the column to the center of the spindle is 56 inches, which allows drilling to the center of a 112-inch circle. The greatest distance from the spindle to the base is 55 inches. With back gears thrown in the spindle revolves in the ratio of 1 to 9, and without back gears in the ratio of 1 to 2 to number of revolutions of the driving cone, which has four steps for changing speed and is driven by a three inch belt. The friction countershaft has 14x4½ pulleys, and gives instant reverse for tapping. There are 285 revolutions per minute. The column is 95 inches high, and the extreme height when the spindle and arm are up is 111 inches.

The 8-foot universal radial drill, which is the largest size of the type shown, has an extreme distance from the center of the spindle to the post of 96 inches. It drills to the center of a 192-inch circle. The width of the base plate is 73½ inches; the greatest distance between the base and spindle is 121 inches.

An injunction has been granted in common pleas court in Cleveland, by agreement of all parties in the case of the Reliance Gauge Column Co. against the Reliance Mfg. Co., perpetually enjoining the latter from using the word "Reliance" either on the steam boiler appliances made by it or in its incorporate name. In consideration of this the gauge company gives up all claims for infringement of patent and withdraws suits pending.

The bi-monthly adjustment of wages of the workers in the sheet mills of the country took place in Pittsburg last week. It was found that the sales for the months of January and February did not warrant an advance in the wages of the men for March and April.

It is reported at Buffalo that operations will begin in a short time looking to the erection of the new steel plant at Stony Point, by the Lackawanna and other interests. Recently some leases of lands owned by the steel plant syndicate were made to farmers for the coming season, indicating that the steel plant project would not be hurried.

The new rolling mill plant of the National Enameling & Stamping Co., at Granite City, Ill., begins operations this week.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Reserve Foundry & Mfg. Co., of Cleveland, has been incorporated with a capital stock of $50 000. The company is formed for the purpose of molding, stamping, casting and manufacturing and dealing in iron, brass and other metals. The incorporators are James B. Ruhl, D. M. Badger, Joy P. Matherson, S. A. Schwab, and J. H Schneider.

The Wing-Sayle Foundry & Machine Co., Little Rock, Ark., has been incorporated, with capital stock of $5,000, by D. R. Wing president C. M. Wing, vice-president Claude Sayle, secretary and treasurer.

The Lawrence Bolt & Iron Works, Baltimore, Md., has been incorporated for the manufacture of builders' and iron structural work, by Joseph B. Backhoff, E. C. Lawrence, Thomas E. Barrett and others, capital stock $5,000.

The Warrior Machine Works, Birmingham. Ala., will buy a car-wheel boring machine for boring 33-inch wheels, new or second hand.

Howard Bros., Dublin, Ga., inquire for a new double-spindle lathe, about 24x48, second hand slide planer, about six or eight foot bed, not to take in less than 32x32.

John F. Riley, Charleston, S. C., is receiving quotations on second hand 24-inch drill press, four-foot planer, bolt cutter to cut from ⅜ to 1½ inches.

W. H. Dexter, Valdosta, Ga., solicits descriptions and prices from manufacturers of pneumatic air drills and hammers and chipping and caulking tools.

The Guilderland Foundry Co., of Guilderland, Albany County, N. Y., has been incorporated to do iron and brass molding, and general manufacturing. The capital is $3,500. The directors are Charles G. Zeilman, James E. Carpenter, and Charles S. Chase, A. Eugene Wilson, all of Guilderland, and William H. Witbeck, of McKownville.

Greth Machine Works, Reading, Pa., capital $25,000, has been incorporated.

Logansport Foundry Co., capital stock, $40,000, has been incorporated in Indiana.

The Reserve Foundry & Mfg. Co., of Cleveland, has been incorporated by Joy P. Matherson, James B. Ruhl, D. M. Bader, S. A. Schwab, and J. H. Schneider. Capital stock, $50,000.

Fires and Accidents:—

At Embreeville, Tenn., March 13, fire destroyed the foundry, machine shops and blacksmith shops connected with the plants of the Virginia Iron, Coal & Coke Co. Loss, $60,000.

Fire in the plant of the J. B. Armstrong Mfg. Co., manufacturer of vehicle springs, Flint, Mich., March 14, caused a loss of $75,000, insured for $41,000.

An explosion at Monongahela Furnace No. 1 at McKeesport, Pa., March 16, killed one man and injured four others, one seriously. Ore, coke and limestone were blown a great distance.

At Torrington, Conn., the plant of the American Brass Co. was damaged to the extent of $3,100 by a fire in the tube mill.

Fire in the boiler shops of the Variety Iron Works, Cleveland, March 18, caused a loss of $15,000 to $20,000, covered by insurance.

The coupling department of the Continental branch of the National Tube Co., on Second ave., Pittsburg, was destroyed by fire, March 17, with a loss of $75,000, covered by insurance. The buildings were one-story steel-frame structures and contained some valuable machinery.

Fire destroyed the scythe manufacturing department of the American Axe & Tool Co., near Balston Spa, N. Y. Loss, $70,000.

New Construction:—

The Chesapeake & Ohio Railway Co. will enlarge its Huntington, W. Va., shops. George W. Stevens is general manager, Richmond, Va.

The Hoffman Engineering Co., Philadelphia, has taken out a permit to construct an angle shop, 160x200 feet, and ship shed 37.6x50 feet, for the Cramp Ship & Engine Building Co. The estimated cost is $26,000.

The Groton Bridge & Mfg. Co., Groton, N. Y., is reported to be planning the erection of a bridge plant at a Southern point.

The Toledo Bridge Co., Toledo, O., is having plans prepared for three new buildings to replace those destroyed by fire some time ago. They will be steel buildings, 600x120, 320x100, and 150x60, and will cost about $250,000. The company has also appropriated a large amount for machinery.

Architects Samuel R. Turner & Son, 629 F. st., Northwest, Washington, D. C., have prepared plans for a machine shop for B W. Clark.

At Richmond, Va., extensive additions and improvements are being made at the plant of the Richmond Locomotive Works.

The Akron, (O.) Foundry Co.'s new foundry will be 35x70 feet, two stories, and will cost $6,000.

At South Bend, Ind., Dirham & Schneider are the architects for the new plant for the South Bend Malleable Iron Co.

At Warren, Pa., the Warren Ax & Tool Co. are receiving bids for a new building. The equipment includes two boilers. 50 h. p.; two engines, 50 h. p.; two pumps, two feed-water heaters. and blower.

J. M. Sommers. proprietor of the Wichita Foundry, Wichita, Kan., will soon begin the erection of a brick foundry building. 50x125 feet.

At Toledo, O., the Excelsior Foundry Co., West Bay City, Mich., will erect a foundry, 65x150 feet.

The American Steam Pump Co., Battle Creek, Mich., will erect a brick and stone machine shop, with a floor area of 3,600 square feet, also a brick and stone power house, with a floor space of 5,000 square feet. A full equipment of boilers, engines and other machinery will be purchased. E. C. Hinman, is secretary and treasurer.

The Pittsburg District:—

Charles H. Wellman, J. W. Seaver, and T. R. Morgan, of the Wellman-Seaver Engineering Co., Cleveland, were in Pittsburg last week, for the purpose of furnishing plans to Pittsburg firms for the plant of the Nickel Steel Co., at Hamilton, Ont. Contracts for the work will be placed shortly. C. H. Bradley, Jr. & Co., Pittsburg, are installing two new boilers at the Braddock water works plant.

W. J. Rainey & Co., Pittsburg, are erecting a fire brick plant at Mt. Braddock, Pa., the output of which will be used in the building of new and in the repair of the Rainey Coke ovens in the Connellsville district. The plant will require an investment of about $80,000.

The new blooming mill which the Frank-Kneeland Machine Co., of Pittsburg, is installing in the Schoenberger works of the American Steel & Wire Co, is almost completed and will be put into operation within the next 60 days.

A charter was granted under the laws of the state of Pennsylvania arch 14. to the Pittsburg Feed Water Heater Co., of Pittsburg, for the manufacture of feed-water heaters, etc. The officers are James Bonar, president; J. E. Schlieper treasurer and general manager, and Joseph Cawley, secretary. The sales department will be under control of James Bonar & Co., Pittsburg, as heretofore. The company will manufacture both the Pittsburg feed-water heaters and purifiers and the Pittsburg tubular feed-water heaters. These heaters have been in use for the last six years and are being adopted by some of the leading steam users; the Carnegie Steel Co., Ltd., alone has installed over 50,000 h. p. and there are 300,000 h. p. in use thorughout the United States. It is the intention of the company to push the sale of these heaters to greater extent than in the past and it is desirous of making connections with different concerns throughout the country to take hold of the product.

The Carnegie Steel Co., Ltd., last week awarded a contract for the erection of a $30.000 residence for Superintendent Joseph E. Schwab, of the Duquesne works, at Duquesne.

The Braddock Tool Co., Braddock, Pa., has applied for a charter to operate a plant for the manufacture of machine tools. The incorporators are: John A. Loew, John W. Mohr, Charles Wolfe, Oswald Muhlenberg, William Seng and

COCHRANE FEED-WATER HEATERS.

MUDDY WATER.

When water is turned into steam within a boiler, what happens if there is mud in this water? The solid particles are certainly not evaporated — what becomes of them? Some are worked out through the blow-off, the rest settle in different parts of the boiler. The lime, magnesia and other chemical impurities act as a cement, binding together the insoluble matter, and scale is formed — hard or soft, according to the amount of baking. The difficulty of removing scale, the cost of doing it, and the losses occasioned through the heat given out by the coal being unable to qu ckly and readily pass through this insulating stuff, are well known.

Why not stop the mud and other impurities from entering the boilers? Why not provide a receptacle in which they can settle and lodge and that will be easier to clean than a boiler? Why not arrange your plant so that you will have to use only about five-sixths of this impure water instead of the full six sixths required to be evaporated?

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HARRISON SAFETY BOILER WORKS, Clearfield & 17th Sts., PHILADELPHIA, PA.

Joseph Striebich, Sr. The capital stock is $25,000 and has all been paid in. A site 40x120 has already been purchased, upon which a modern machine shop will be erected.

Robert Munroe & Sons, boiler manufacturers, have received an order from the Crescent Steel Co. for eight 54x8 foot boilers. The company also has an order for two 150 h. p. boilers for the La Belle Steel Co., Allegheny.

The Rankin wire mills of the American Steel & Wire Co. produced in 10 hours 445,000 pounds of common wire last week.

The Miller Engineering Co., Pittsburg, was awarded a contract last week by the Latrobe Steel Coupler Co., Melrose Park, Chicago, for the erection of a 35-ton open-hearth furnace.

The Pittsburg Bridge Co., Pittsburg, Pa., has been awarded the contract by the Solvay Process Co., of Syracuse, N. Y., for the erection and partial equipment of a building at Detroit that will cost about $90,000. The plant will be used in the manufacture of tar and soda ash.

F. W. Waterman, connected with the Dominion Iron & Steel Co., whose plant on the island of Cape Breton is being erected by the Riter-Conley Mfg. Co., was in Pittsburg this week.

Judge Edwin H. Stowe has granted the remaining defendants to the suit of H. C. Frick, an extension of 15 days in which to file their answers. It is the impression in legal circles that the suit will not come up for trial until October.

General Industrial Notes:—

The statement that the Empire Steel & Iron Co., of New York, has sold its Oxford, N. Y. plant to Janson Bros., of Columbia, Pa., is incorrect. The company simply sold a small muck-bar rolling mill which is attached to the furnace, and still owns and operates the furnace and ore property.

The Spence-Bagg Stove Co., Martins Ferry, O., has been incorporated with $60,000 capital stock.

The Sharon Steel Co., Sharon, Pa., has awarded the contract for the erection of a ten-mill tin plate plant to R. Newbold & Son, Norristown, Pa. The mill will contain ten hot and nine cold rolls.

The Struthers Iron & Steel Co., Struthers, O., recently shipped four cars of corrugated galvanized sheet iron to Cuba. The iron is to be used in the construction of buildings. This company also reports inquiries from Mexico, and shipments to that country will likely be made in the near future.

At a meeting of the board of directors of the Pittsburg Stove & Range Co. last week a committee was appointed to visit New Castle, Pa., for the purpose of looking over the field, with a view of locating all the company's plants there.

The Youngstown, O., plant of the National Tube Co., which was shut down for several weeks undergoing repairs, resumed operations this week.

The Milwaukee Electric Railway & Light Co. has placed an order through the Milwaukee-Rice Machinery Co., of Milwaukee, for a large quantity of heavy machinery, for use in its construction and repair department. Among the machines furnished were: 36-inch Putnam frog planer, 600-pound Chambersburg steam hammer, 12-inch throat Williams & White double punch and shear, 26-inch Gould & Eberhardt triple geared shaper, No. 2 Newton rail saw, American Bridge Works rail bender, and a quantity of air drills and hammers. This is one of the largest contracts for iron working machinery taken in Milwaukee for some time.

The Newark, (O.) Weldless Tube Works have been reor-

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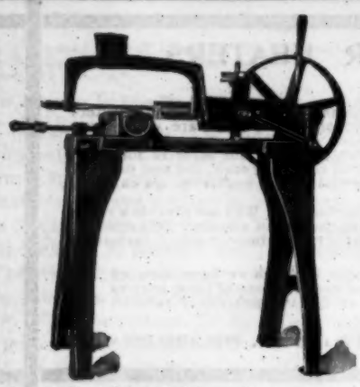

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ganized under the name of the Newark Iron & Steel Co., capital $100,000. A new open-hearth furnace will be installed. The plant is under the management of J. R Goldsborough.

HOME-MADE MACHINE TOOLS.

The remark of a prominent tool builder who was going through a machine shop the other day may be found instructive to many. Stopping before a special machine that had been built in the shop where it was being used, and for performing a certain manufacturing operation, he watched its working for a few minutes and examined the work it was doing, then he said: "Now, if I or any other tool builder were to build for these people such a tool as that, do you suppose for one moment that they would accept it and pay me for it? By no means; they would try it for a few days and then throw it out as utterly unsatisfactory, unfit for the work and a disgrace to their shop. But having been built here and having enlisted the interest of the superintedent, the foreman, the proprietor, and the man who runs it, it is made to do; its many and manifest shortcomings are ignored or excused, and the machine is not only kept in service, but its miserable performance is actually extolled and the machine bragged on."

Just here the tool builder touched a point of human nature. It is perfectly easy to understand why things should go as he described them. The man who buys a machine to do certain work is generally a sharp critic of that machine; the least fault, even though it be so small as to be mainly imaginary, is magnified; no apology is made for it, and the builder hears by next mail that the result of all his careful planning and study of the machine is a worthless contraption that he can come and take away as soon as he pleases. But how different it is with the home-made tool. Its idiosyncrasies are borne with and excused; it has a larger or a smaller pulley put on it here and a new gear or a new spindle there, and finally, when it is made to work after a fashion, it is pronounced an unqualified success. This throws some light also upon the reason why tool builders so often fail to take up for manufacture and sale tools that have been thus constructed in the shops where they are used, and which are thought by their constructors to be something in the nature of a wonder that any tool builder ought to be glad to get hold of. The tool builder simply knows that the tool is in the hands of its friends, who are bound to make it work successfully, if such a thing is at all possible; whereas, if he builds it, he knows that it will go into the hands of men who will be interested no further than in seeing that the machine "goes" without trouble from the start, and who will in many cases excuse no defect or apparent shortcoming but will immediately conclude, if they can find any fault with it whatever, that they have not got their money's worth. It makes a great difference with the machine whether it is in the hands of its friends or of those who may be its enemies, or at least indifferent to it.

We are not prepared to say that this feature of the machine tool business is on the whole a bad one. It has its manifest advantages. It occasionally leads to the development, step by step, of a machine tool that is finally made an all-around success, and which perhaps no tool builder would have been sufficiently interested in to have stuck to it until it had been perfected; while, on the other hand, the expectations and requirements of customers are among the principal incentives to strive for perfection of detail. We mention the matter simply because it is, we think, interesting, and when fully

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This bureau consists of experienced agents whose duties are to meet passengers arriving in Jersey City and New York over the Pennsylvania Lines and assist them in arranging for trans-Altantic trips via any of the steamship lines by conducting them to steamships and aiding in preparations for a trip abroad.

These agents will provide cabs operated by the Pennsylvania System and aid passengers with their baggage. They are fully posted on matters pertaining to steamships leaving New York, and arrangements can be made through them for procuring steamship tickets in advance.

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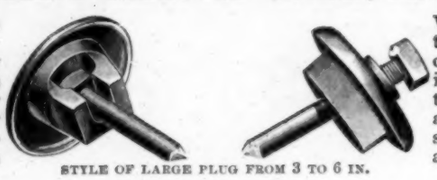

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Rail Mills,
Structural Mills,
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Cut-Nail Works,
Tin Plate Works,
Stamping Works,
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Iron and Steel Ship Builders,
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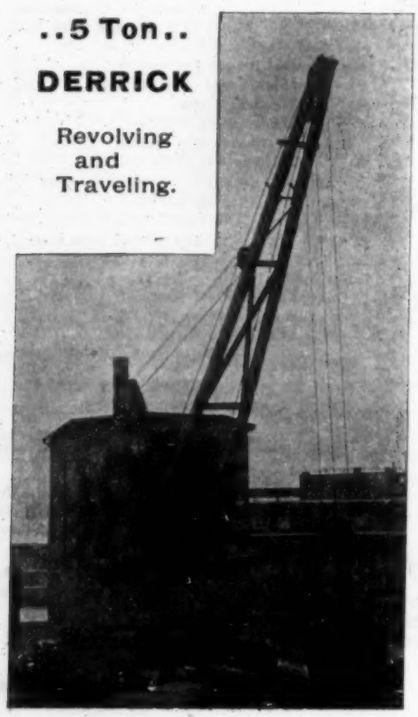

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P.M.	P.M.	A.M.	LV AR.	A.M.	A.M.	P.M.
4:25	1:05	7:05	Lorain	9:10	11:30	6:37
4:40	1:20	7:20	Elyria	8:54	11:16	6:23
4:56	1:38	7:41	Grafton	8:35	10:59	6.05
5:15	1:57	8.00	Lester	8:15	10:41	5:47
5	3	1	Main Line	2	4	6
4:40	1.00	7:10	Cleveland	9:10	11:40	6:40
4:54	1:16	7:24	Brooklyn	8:54	11:24	6:26
5:45	2:02	8:14	Lester	8:10	10:40	5:40
5:56	2:11	8:23	Medina	7:55	10:30	5:26
6:19	2:30	8:43	Seville	7:33	10:10	5:05
6:26	2:36	8:49	Sterling	7:27	10:04	4:59
6:48	2:58	9:11	Warwick	7:05	9:42	4:35
6:56	3:05	9:18	Canal Fulton	6:58	9:35	4:28
7:16	3:23	9:39	Massillon	6:40	9:18	4:11
7:31	3:40	9:58	Justus	6:24	9:03	3:55
8:11	4:11	10:26	Canal Dover	5:55	8:34	3:26
8.08	4:18	10:33	New Philade	5:48	8:27	3:18
8:25	4:35	10:50	Uhrichsville	5:30	8:10	3:00
	4:50	11:15	D. " A.	.....	8:10	3:00
	6:50	1:15	Bridgeport	.....	6:10	1:00
	7:05	.....	Bellaire	.....	5:55	.....
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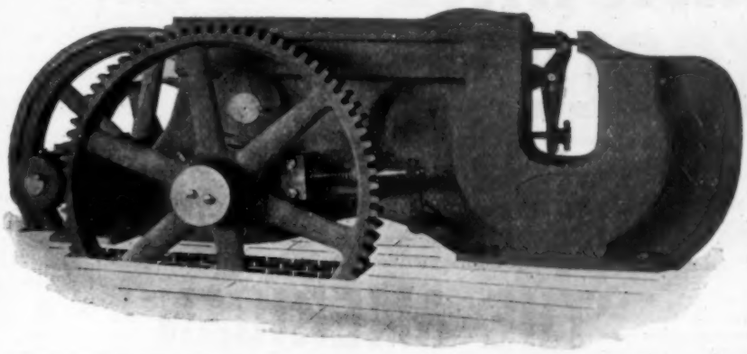

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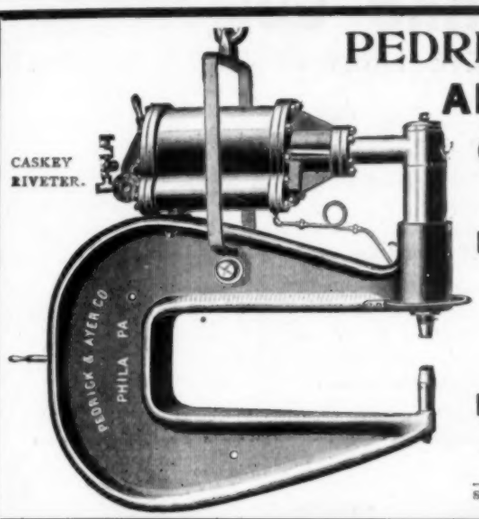

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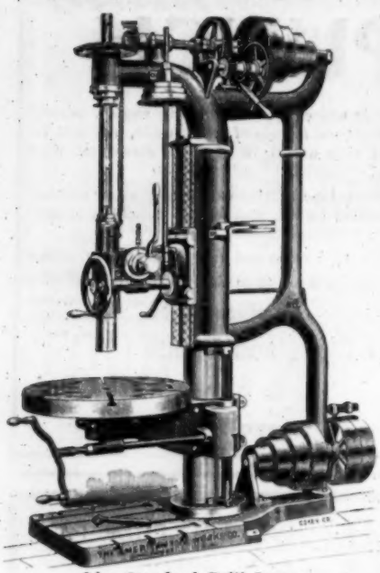

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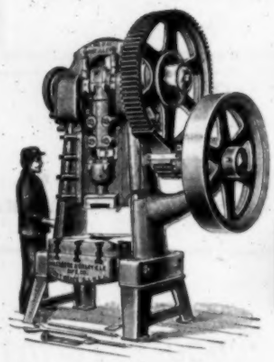

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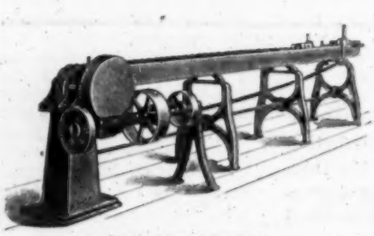

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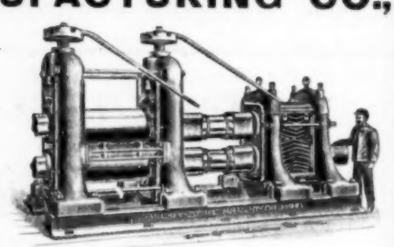

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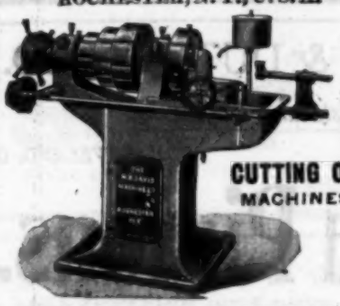

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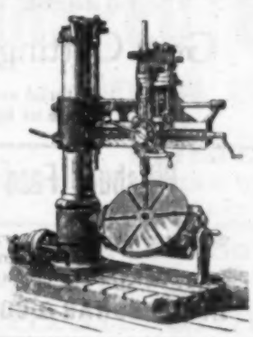

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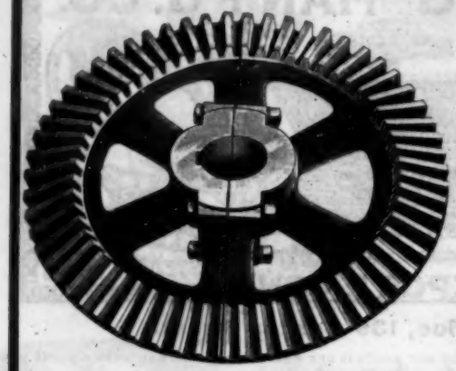

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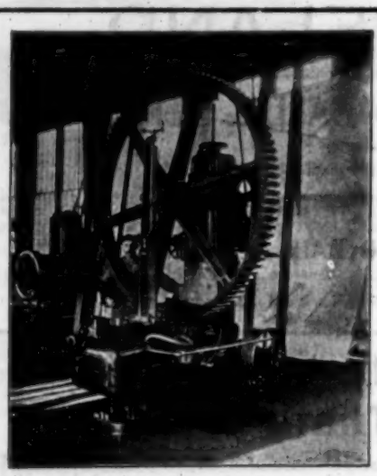

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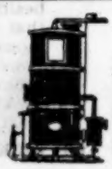

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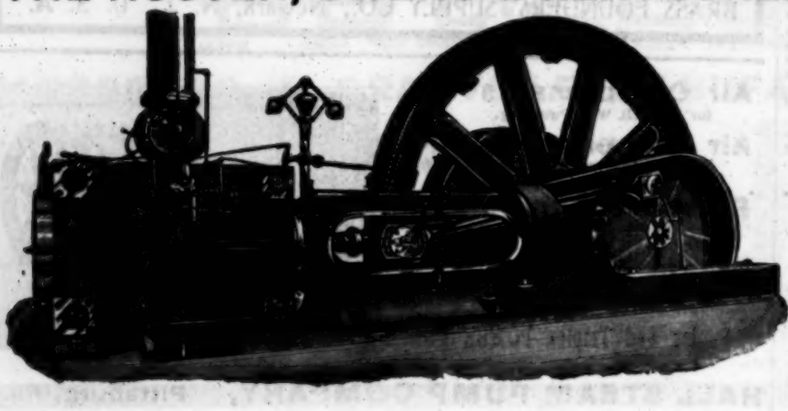

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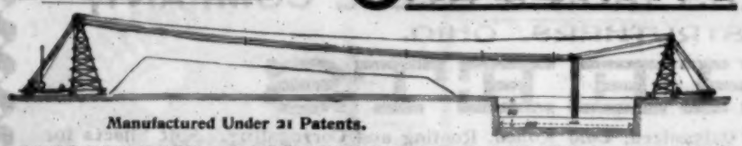

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AN OPEN LETTER.

To the Editor of The Iron Trade Review:

Doubtless many of your readers are users of nuts, and if so have experienced the common difficulty of keeping them tight on the bolts.

No matter how tight they are when first put on, they soon work loose and rattle off where there is any jar or vibration. In fact this is the acknowledged and almost universal complaint, as is eloquently proclaimed by the various nut-locks, jam-nuts, spring-washers, keys, etc., on the market, gotten up in the vain attempt to fasten a nut securely and permanently. Experience has proven most of these wholly inefficient after a short time, and that all of them, without exception add greatly to the cost of the nut.

In view of the above, we believe that your readers will be interested to learn of a thoroughly practical and successful self-locking nut, that locks itself on the bolt wherever placed and that effectually and completely overcomes the difficulties presented above.

This is our Elastic Self-locking Steel Nut, and we have thought best to take this space in your valuable paper to tell your readers something about this wonderful nut that has proven so simple, efficient and inexpensive, that it has within the last few years fairly supplanted the use of the common nut where nuts are liable to work loose. On that account it is now used regularly by many of the largest Railroads, Bridge Builders, Machinery Manufacturers, Engineers, Car Builders, etc., of the country. The Elastic Nut owes its self-locking feature to its peculiar manufacture, as it is made in an entirely different manner from the ordinary nut. It is made of a flat bar or section of steel bent around into a ring, and then this ring is pressed into the shape of a nut having a lapped opening on the side. It is then tapped or threaded slightly smaller than the standard bolt, so that when wrenched on, the nut is distended a trifle and grips the bolt which holds it from ever working loose like the ordinary nut.

Being made in this manner and of steel, the Elastic Nut is always stronger than the bolt, and if put down to breaking strain will invariably break the bolt without injuring the nut in the least. In fact, as one customer puts it, "It makes a fastening on the thread end of the bolt as strong, permanent and secure as is the bolt head on the other," and at a much less cost than any other method. Also for use where a self-locking nut is not required, by simply tapping them full standard instead of scant, they are then practically the common nut and many large concerns whose work does not require a self-locking nut, are using them in this way.

These nuts though much superior in every way to the ordinary iron nut, can be furnished for considerably less, as the special method of manufacture saves entirely the ordinary scrap waste of about forty per cent. We are therefore able to furnish users of nuts with the best nut on the market (either self-locking or not as desired) and at a less price than the ordinary nut. We make these nuts in sizes from ⅝ in. up to 1¼ in. both inclusive and can furnish them either rough for ordinary railroad and car work or semi-finished and finished for finer machine work.

As previously stated, many of the largest concerns are using these nuts, and from our list of orders we mention, New York Central & Hudson River Ry., Haskell & Barker Car Co., Pennsylvania Steel Co., The Edward P. Allis Co., Fraser & Chalmers, The Atlantic Works, Link Belt Engineering Co., National Machinery Co., etc.

We issue a little booklet giving additional information that we will be glad to send to any of your readers who will write for it, and shall also be glad to send samples and prices on request. Hoping that we may hear from them liberally, we are,

Yours truly,

National Elastic Nut Co.,
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Per T. L. Paine, Manager.

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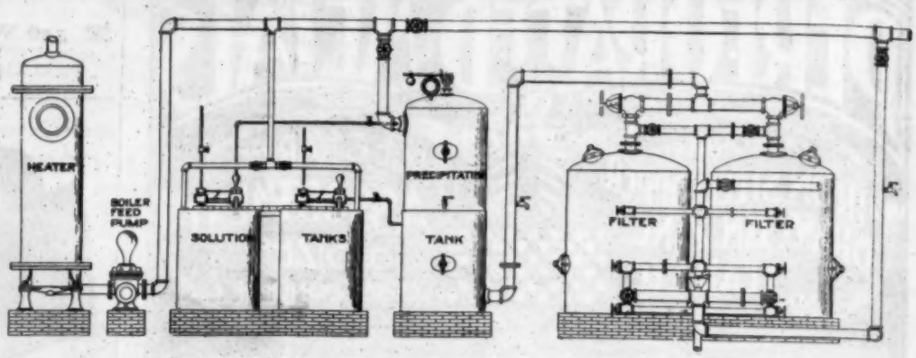

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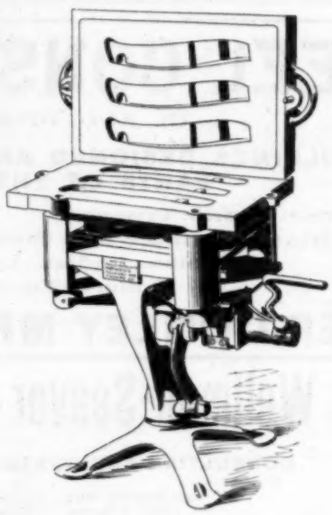

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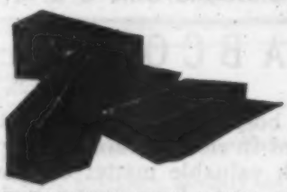

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MONONGAHELA IRON & STEEL CO.,
Manufacturers of
Charcoal Bar Iron CARTER BRANDS Charcoal Iron Chain
All Sizes
United States Government Specifications Guaranteed. PITTSBURGH, PA.

Don't Waste Money in Your Pattern Shop.
THE GOBEILLE PATTERN CO., Cleveland.

FORSYTH PATTERN WORKS. Youngstown, Ohio
MACHINE AND ARCHITECTURAL PATTERNS OF ALL DESCRIPTIONS.
Gear Work a Specialty.
Patterns for Castings from ¼ pound to 50 tons. Send on your Drawings and get prices.

SOLID
SHEAR KNIVES
SAMUEL TRETHEWEY & CO. LTD.
PITTSBURG, PA.
ESTABLISHED 1883

Persistent Advertising.

One who watches carefully the pages of general advertising mediums is struck by two things: the persistency with which those advertisers who are recognized as successful maintain their advertising week after week, month after month, and year after year; they never seem to abate their effort, and apparently the volume of their business increases steadily. The other thing noticeable is the large number or advertisers who thrust their announcements above the surface for a little while and then sink into oblivion. They either had not merit as a basis for their claims or they did not possess the skill to steer their enterprise successfully, or else they lacked the nerve to put forth proper effort.—[Advertising Experience.

STEEL FORGINGS. Frankford Steel & Forging Co.,
PHILADELPHIA, PA.
Chicago Office: 1030-1031 Monadnock Building, Frederick H. Mason, Manager.

"The Alpha and Omega of the pressed steel car," writes the General Superintendent of a great American railroad, "is that it admits of a maximum of revenue-bearing tonnage being hauled with a minimum of dead weight." . . . THAT IS WHAT IT IS BUILT FOR.

PRESSED STEEL CAR COMPANY.

PITTSBURGH. NEW YORK. CHICAGO. PHILADELPHIA. JOLIET.

WATERBURY ROPE CO.,

Factories: Brooklyn, N. Y. Office: 69 South St., New York.

MAKERS OF

WIRE ROPE

OF ALL KINDS. ALSO

Manila, Sisal, Russia and American Cordage and Binder Twine, and

"WATERBURY" Transmission and Hoisting Rope.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case B'ld'g.

CLEVELAND, O.

Order direct from The IRON CLAD PAINT CO and get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

Iron Clad Paint

is the MOST DURABLE, MOST FIRE-PROOF and CHEAPEST PAINT made.

Furnished both Dry and Ground in Oil.

Used by nearly all the Railroads.

BRASS FOUNDERS FINISHERS J. J. RYAN & CO.

6874 West Monroe St., Chicago.

Best Bronze, Babbitt Metals, Brass and Aluminum CASTINGS

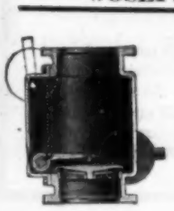
DIXON'S SILICA GRAPHITE PAINT

FOR TIN OR SHINGLE ROOFS AND IRON WORK. IT IS ABSOLUTELY WITHOUT AN EQUAL.

Tin roofs well painted have not required repainting for 10 to 15 years.

If you need any paint it will pay you to send for circular.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.



Excelsior Straight-Way Back Pressure Valve

This valve has no dash pots, springs, guides or complicated levers to get out of order. It is simple, reliable and well made Never sticks, and can be relied upon at all times when using exhaust steam for heating; or when used as a relief, or free exhaust on a condensing plant, it has no equal. It is noiseless and free from any complicated attachments.

JENKINS BROTHERS, NEW YORK, PHILADELPHIA, BOSTON, CHICAGO.

J. M. ALLEN, President.

WM. B. FRANKLIN, Vice-President.

F. B. ALLEN, Second Vice-President.

J. B. PIERCE, Secretary and Treas.

BURWELL & BRIGGS, General Agents, 32 and 33 Clark Bldg., 208 Superior St., Cleveland, O.

C. A. BURWELL, Chief Inspector, 32 and 33 Clark Bldg., 208 Superior St., Cleveland, O.

J. E. WOLCOTT, Special Agent, 32 and 33 Clark Bldg., 208 Superior St., Cleveland, O.

Persistence In Advertising

Is one of the requisites of satisfactory results. In the expansion of business which is now noticeable in every section of the country, advertisers who have made themselves regularly prominent in the past two years will be first to reap the rewards of persistent publicity.

THE CENTRAL ELECTROTYPE AND ENGRAVING CO.

263-271 St. Clair St. Cleveland, O.

WOOD ENGRAVING ELECTROTYPING.

"Metallurgy of Cast Iron," Price $3.

NATIONAL TUBE COMPANY,

Manufacturers of

BLACK and GALVANIZED
Wrought Merchant Pipe, all kinds: sizes 1-8-inch to 30-inch, fitted in any manner desired.

BOILER TUBES,
Mild Steel and Charcoal Iron, for Stationary, Locomotive and Marine Work.

CASING, TUBING
and Drive Pipe for Well Purposes.

GAS AND OIL LINE PIPE.

CYLINDERS,
Lap-Welded and Seamless, tested from 100 to 3,700 lbs., for Compressed Air, Carbonic Acid Gas, Anhydrous Ammonia, etc., etc., etc.

WATER and GAS MAINS,
Converse and Matheson Lead Joint Pipe, 2-inch to 30-inch.

SEAMLESS
Tubes, Shrapnel, Projectiles and Miscellaneous Forgings.

Office of President and Treasurer, Havemeyer Bldg., NEW YORK CITY.

Office of Mercantile and Manufacturing Departments, Conestoga Bldg., PITTSBURG, PA.

LOCAL SALES OFFICES:

Havemeyer Building, NEW YORK CITY. 70 Federal St., BOSTON.
267 S. 4th St., PHILADELPHIA.
Fidelity Building, PITTSBURG. Western Union Building, CHICAGO.

Foreign Office: Dock House, Billiter Street, LONDON. Telegraphic Address: TUBULIFORM, LONDON.

National Steel Company

BATTERY PARK BUILDING, NEW YORK, N. Y.

Manufacturers of

Bessemer and Open-Hearth Billets

Sheet and Tin Plate Bars.

THE CASTING AND CONVEYING OF METAL

Exhibit showing furnaces where the UEHLING METHOD has been adopted.

Location.	Stacks.	Daily Capacity. Tons.	Style Machine.
National Tube Works Company, McKeesport, Pa.	2	600	Double.
Carnegie Steel Company, Ltd., Duquesne, Pa.	4	2,400	Double.
Carnegie Steel Company, Ltd., Edgar Thompson	9	3,500	Six.
Carnegie Steel Company, Ltd., Rankin (Carrie)	2	700	Double.
Carnegie Steel Company, Ltd., Pittsburg (Lucy)	2	800	Double.
Struthers Furnace Company, Struthers, O.	1	300	Single.
Laughlin & Co., Ltd., Pittsburg, Pa. (Eliza)	5	2,000	Double (2).
Oliver & Snyder Steel Company, Pittsburg, Pa. (Edith)	1	400	Double.
Oliver & Snyder Steel Company, New Castle, Pa. (Rosena)	1	500	Double.
Shenango Valley Steel Company, New Castle, Pa.	2	800	Double.
Bellaire Steel Company, Bellaire, O.	2	700	Double.
Lebanon Furnaces, Lebanon, O.	2	500	Double.
Tennessee Coal, Iron & Railroad Company, Ensley, Ala.	4	800	Double.
Riverside Iron Works, Wheeling, W. Va	2	700	Double.
American Steel & Wire Co.	7	3,000	Double (3).
Totals	46	17,700	

For particulars write

G. H. GINTHER, Special Agent, Carnegie Bldg., Pittsburg, Pa.

BY THE

Uehling Method

is covered by U. S. patents Nos. 548,146, 629,480 and 632,031, which are fundamental, and others are pending.

The use of the Uehling Method at the furnaces mentioned has shown reduced labor cost, while SANDLESS IRON has proved a great advantage to the consumer.

AMERICAN STEEL AND WIRE CO.

CHICAGO. NEW YORK. SAN FRANCISCO.

FOR RAILROAD USE WE MAKE

Woven Wire Railroad Fences.

The "AMERICAN," "ELLWOOD" and "McMULLEN" RAILROAD FENCES.

High Carbon Steel Wires woven together so as to provide amply for expansion and contraction.

Thoroughly galvanized so as to secure length of life. ABSOLUTELY the BEST and CHEAPEST RAILROAD RIGHT-OF-WAY FENCES. Write for Catalogue.

We take contracts for the erection of Railway Right-of-way Fences anywhere in the world, having our own experienced employes, our own trains and equipment, for doing this class of work in the best and cheapest manner.

ELECTRICAL WIRES.

Galvanized Iron and steel Telegraph Wires made in accordance with W. U. and Postal Telegraph Companies' most rigid specifications.

Copper Wires and Cables of all kinds.

Insulated Wires and Cables for every purpose.

Lead encased Wires and Cables of all sizes for underground work.

Copper Rail Bonds—acknowledged the best wherever used.

Copper Trolley Wires.

WIRE ROPE.

Iron and Steel Wire Rope for all purposes.
Galvanized Guy Ropes.
Galvanized Steel Signal Strand.
Locomotive Switching Ropes, complete.
Plow Steel and Crucible Cast Steel Hoisting Ropes.
Ballast Unloader Cables fitted complete.
Transmission Rope.
Cableways for Mines, Quarries, or Excavating work of all kinds.
Suspension Bridge Cables.

SPRINGS.

Flat and Coiled Wire Springs of every size and for every purpose made in accordance with specifications in every detail.

CAR TRUCK SPRINGS. TROLLEY SPRINGS.
CAR SEAT SPRINGS. BUNK SPRINGS.
BRAKE SPRINGS.

Any desired temper. Any desired grade of Steel.

SHAFTING.

Cold-drawn Steel Shafting, any size, highest quality, lathe-cut or saw-cut ends, guaranteed perfect. Rounds, Squares, Hexagons, Flats or odd shapes.

Wire Nails. Spikes. Pole Steps. Tacks. Rivets. Staples.
Lightest and Best Barb Wires.

NOTE OUR "DIFFERENTIALS."

We make our own steel, and accurately fulfill all specifications as to exact quality. We are able to guarantee quality by our own personal and intimate knowledge of our Steel. We are in position to see that you get just what you want for your "different" or special needs, depending for exact knowledge on none but our own works.

Jones & Laughlins, Limited,

AMERICAN IRON & STEEL WORKS.

PITTSBURGH,

BRANCH HOUSE, CHICAGO, ILL. BRANCH OFFICE, 220 BROADWAY, NEW YORK.

We invite attention to the full line of Bars, which we manufacture.

FLATS, 1-2 inch to 14 inch.

SQUARES, 3-16 inch to 4 inch.

ROUNDS, 3-16 inch to 7 1-4 inch.

Bessemer and Open Hearth Qualities. Orders Solicited. Prompt Service

CHAMPION IRON & STEEL COMPANY

MANUFACTURERS OF

Open Hearth Ingots, Billets and Bars,
Merchant Bar Iron and Bar Steel.

Also Buyers of

WROUGHT IRON AND STEEL SCRAP.

Muskegon, Mich.

Solicit correspondence.

American Steel Hoop Company,

General Offices: PITTSBURG.

MANUFACTURERS

Steel Hoops
Steel Bands
Cotton Ties
Steel Bars
Special Shapes
Angles
Channels
Small Tee Rails
Bar Iron
Pig Iron
Open Hearth Steel

District Sales Offices:

New York	Chicago	St. Paul
Empire Building	Marquette Building	Endicott Building
Boston	St. Louis	San Francisco
8 Oliver Street	Fullerton Building	23 Davis Street

WEST AND SOUTH

run the lines of the Illinois Central Railroad and the Yazoo & Mississippi Valley Railroad, reaching into the eleven States of

South Dakota	Kentucky
Minnesota	Tennessee
Iowa	Arkansas
Wisconsin	Mississippi
Illinois	Indiana Louisiana

Presenting an unequaled territory for diversified industries, and possessing

Fine Sites for New Mills

Best of Freight Facilities.—Coal Fields,

Close Proximity to Distributing Centers

Intelligent Help of All Kinds,

Many Kinds of Raw Material.

To sound industries, substantial inducements will be given by many of the places concisely described in the pamphlet "100 Cities and Towns Wanting Industries." Write for a copy. Nearly all kinds of industries are wanted. Very liberal inducements are offered TEXTILE INDUSTRIES in the South by a number of good places. GEORGE C. POWER, Industrial Commissioner I. C. R. R. Co. Chicago

A large and growing circulation among machine shop and foundry firms has

THE IRON TRADE REVIEW.

REPUBLIC IRON & STEEL COMPANY,

General Offices: Stock Exchange Building, CHICAGO, ILLINOIS.

BAR IRON:	BAR STEEL:	PLATES
Common, Refined, and B.B. Iron,	Bessemer and Open Hearth,	and Angles, Turnbuckles,
Flats, Rounds, Squares, Ovals, etc.	Flats, Rounds, Squares, Ovals,	"T" Rails, 8 to 20 lbs.,
Chains and Rivet Iron,	Angles, Channels, Special Shapes,	Cold Rolled Steel, Cut Nails,
Maud S. Horse Shoe Bar,	Round Edge Steel Tire,	SHEETS (Black and Galvanized),
Skelp Iron, etc.	Agricultural Shapes, etc.	Harrow Teeth, Bolts and Nuts,
		R. R. SPIKES,
		Steel Fence Posts, Steel Whiffletrees, CrossArmBraces, PoleSteps.

FOUNDRY, BESSEMER AND MILL PIG IRON.

DISTRICT SALES OFFICES:—

Ellicott Square, Buffalo, N. Y.; Manhattan Life Building, New York; Perry Payne Bldg., Cleveland, O. Mermod-Jaccard Bldg., St. Louis; Birmingham, Ala.; Cincinnati, O.; Endicott Arcade, St. Paul, Minn.

THE

LORAIN STEEL COMPANY,

Lorain, Ohio.

Rails, Blooms, Billets and Slabs.

American Tin Plate Company

MANUFACTURERS OF

Coke Tin Plates,

Charcoal Tin Plates,

High Grade Terne Plates,

Black Plates.

GENERAL OFFICES:

Battery Park Building,

NEW YORK CITY, N. Y.

Wants and Sales

For our subscribers and advertisers only, we will insert under this head advertisements of help wanted and situations wanted free of charge. The advertisements to be inserted in three consecutive issues and to consist of not more than six lines each. All other advertisements will be charged at regular card rates.

Wanted—Ten good machinery molders; wages $3 per day to competent men. Standard Foundry & Mfg. Co., cor Herald st and Grand av. Cleveland O.

Wanted—Metal pattern maker. Apply corner Elm and Winslow, Forest City Foundry & Mfg. Co., Cleveland, Ohio.

Machinists wanted; good men only. Columbus Machine Co., Columbus, Ohio.

Wanted—First class patternmakers and molders, those accustomed to cast iron pipe work preferred. The Massillon Iron and Steel Co., Massillon, Ohio.

Wanted—Foreman for gray iron foundry in Massachusetts. State experience and salary expected. 106, care THE IRON TRADE REVIEW.

Wanted—Man familiar with laying out and rivetting structural and tank work in the shop. Capable of handling a few men. Good prospects. Address 105 care THE IRON TRADE REVIEW.

Wanted—One second-hand steam hammer, 1000 lbs. to 2000 lbs. capacity, of either Morgan, Sellers or Bement make. State condition and lowest price. Address Steam Hammer, care THE IRON TRADE REVIEW, Cleveland, Ohio.

Wanted—Experienced press man to take charge of our stamping department; steady job and good wages for the right man. E. Konigslow & Bros., 185 Champlain st., Cleveland, Ohio.

Wanted—Six men experienced in electric wiring Apply to American Shipbuilding Co., Lorain, O.,

Wanted—Three or four good molders for machinery castings; standard wages and steady job offered to good, sober, industrious mechanics; state experience, age, and give references. Apply or address Kenney & Co., Scottdale, Pa.

Wanted—Six or seven Union molders on machinery castings. Clean, light, well equipped foundry. No trouble. Steady work. Also two or three good machinists. The Geo. B. Sennett Co., Youngstown, O.

Wanted—Foundry foreman. First class man for large shop making light work. State experience, age, references and wages expected. Box 107, care THE IRON TRADE REVIEW, Cleveland, O.

FOR SALE.

Ten 54 in. by 16 ft. second-hand tubular boilers, including fronts, castings and fittings; boilers are in splendid condition. McNeil Boiler Works, Akron, Ohio.

FOR RENT OR SALE.

The Axle Works property No. 694 Broadway at Junction of Broadway, Erie and Cleveland Terminal & Valley railway, Cleveland, O., including engine, boiler and shafting; or will erect on these premises buildings to suit tenant, if leased for a term of years. Address

CLEVELAND AXLE MFG. CO.,
Canton, O.

ESTABLISHED 1854.

WE OWN—FOR SALE,

For Immediate Delivery.

1 Mundy 7 x 12 single cylinder, single drum Hoisting engine, with boiler
1 8 x 10 Atlas Automatic Engine.
2 Dean Duplex Pumps, 10 x 6 x 10.
1 No. 5 Nye Pump.
1 No. 8 Centrifugal Pump.
1 No. 6 Centrifugal Pump.
1 Gardner Duplex Pump, 6 x 4 x 6.
1 Smith-Vaile Duplex Pump, 3 x 3 x 4.
1 Worthington Duplex Pump, 4½ x 2¾ x 4.
1 American Hoist, Double Gear Crab.

Our specialties are:

CARS,
LOCOMOTIVES,
STEAM SHOVELS.

Write us.

TORBERT & PECKHAM,

16th Floor. - - Monadnock, Chicago.

FOR IMMEDIATE DELIVERY

ANGLES, BEAMS,
CHANNELS, PLATES,
TEES, ZEES, BARS.

Cut to specified sizes.

5,000 tons in stock. Moderate prices. Send for stock sheet and quotations.

Structural Department.

ILLINOIS STEEL CO.,

Designers, Manufacturers and Erectors of Structural Iron Work. Dealers in Structural Materials.

50 Wabansia Ave, CHICAGO.

FOR SALE.

100 SECOND-HAND STEAM PUMPS.

VARIOUS STYLES AND SIZES.

Send for descriptive price list.

PATTIN BROS. & CO.,
Marietta, O.

New and Relaying Rails

FOR SALE.

16 and 20 lb. Steel Relaying Rails with splices, Louisiana.

25 lb. Steel Relaying Rails with splices, Michigan.

40 lb. Steel Relaying Rails with splices, Ohio.

50 and 60 lb. Steel Relaying Rails with splices, Pennsylvania.

All first class condition, subject to any inspection. Immediate shipment.

HYDE BROS. & CO.,
Lewis Block, PITTSBURG.

RAWHIDE GEARS.

Nazel & Bassett,
Engineers and Machinists,
1046 Ridge Ave., PHILADELPHIA, PA.

First Class Iron and Steel Salesman

of recognized ability and character, 20 years' experience, native New Yorker, will do a general brokerage business here and London about June 1st. Requests those contemplating placing agencies or employing salesmen to make an appointment for the month of May when advertiser will visit them. Address HUSTLER, *Iron Age Office*, 238 William st, New York City.

PAY-ROLL FIGURING

Is EASY and SURE with the **Ellis Wage Scale Board**, which gives instantly wages for any number of hours from 5 minutes to three months at any rate of wages paid and without any figuring. Have boards figured for 48, 50, 51, 52, 53, 54 55, 56, 57, 58, 59, 60 and 66 hour weeks. Is on 3 ply veneer, size 12x24. Price $2.00 express prepaid. Send for one today.

ELLIS MFG. CO.,
277 So East St., GRAND RAPIDS, MICH.

FOR TESTING IRON ORE BODIES

or drilling deep test holes in ANY formation—gravel, boulders and rock. Drives 4, 6, 8 or 10-inch pipe, or drills holes that size in rock, and

PRODUCES AT THE SURFACE EVERYTHING FOUND.

Tests for gold, lead, zinc, coal—everything. Can be used on boat, to explore river beds to bed rock. Water no hindrance. Drills water and oil wells quickly, cheaply and without skilled labor. Self-moving; complete.

Write for full information and catalogue.

THE KEYSTONE DRILLER CO.,
BEAVER FALLS, PA., U. S. A.

BEAMS

I Beams, all sizes, 3 in. to 24 in.
Channels, " 2 in. to 15 in.
Angles, " 2 in. to 6 in.
Zee Bars, " 3 in. to 6 in.

IN STOCK.

CUT TO LENGTH, PUNCHED AND FITTED.

W. W. LINDSAY & CO., 15th & Market Sts., **PHILADELPHIA.**

Business For Sale.

Through the rapid growth and constantly increasing demand for space of the other departments of our business, we are compelled to offer for sale our gas and gasoline engine business.

We sold during the past calendar year over 125 engines, averaging between 10 and 20 H. P., and ranging in size from 3 H. P. to 50 H. P.

Included in our offer are all drawings patterns, patents, jigs, templates, special tools, finished and unfinished stock, and also about 60 engines ready for immediate delivery.

The business is thoroughly organized and can be continued without interruption. Parties having the necessary capital will be offered the fullest opportunity for investigation upon satisfactory proof of their sincerity.

Address all replies to "E. E. S.,"
Care of IRON TRADE REVIEW.

BEAMS, CHANNELS, ANGLES, ZEES, PLATES.

2000 Tons in Stock.

Eye Beams, 4 inch to 20 inch, inclusive.
Channels, 4 inch to 15 inch, "
Equal Angles, 1¼ x 1¼ to 6 x 6, "
Unequal " 2½ x 2 to 6 x 4, "
Plates, ¼ inch thick and over.
Zees, 3 in., 4 in., 5 in. and 6 in.

All material in 50 to 70 ft. lengths or cut to specified lengths when desired. Shipments promptly on receipt of order. Send for detail stock list.

THE FOREST CITY STEEL & IRON CO.,
Cleveland. O.

WANTED.

One second hand Steam Hammer 1000 lbs. to 1200 lbs. capacity,—of either Morgan, Sellers, or Bement make. State conditions and lowest price.

Address
STEAM HAMMER,
Care THE IRON TRADE REVIEW, Cleveland, O.

FOR SALE.

48 in. x 48 in. x 18 ft. Pond Planer—four heads, slightly second hand. Also, 26 in. x 26 in. x 10 ft. Gray Planer—one head.

BROWN & ZORTMAN MACHINERY CO.,
Pittsburg, Pa.

FOR
ARTISTIC
PRINTING
WRITE
THE
CLEVELAND
PRINTING &
PUBLISHING CO.,
CLEVELAND, O.

"Metallurgy of Cast Iron,"

Price $3.

WEST PENN FOUNDRY & MACHINE CO.,
AVONMORE, PA.

Manufacturers of
TIN, SHEET AND BAR MILL PLANTS.
Blast furnace work. Steel work. Hydraulic machinery. General castings of every description.

AETNA & CORLISS ROLLING MILL ENGINES
THE TOTTEN & HOGG IRON & STEEL FOUNDRY CO.
OFFICE & WORKS
24TH ST. & A.V.R.R.
PITTSBURGH, PA.
PINIONS, CHILLED & SAND ROLLS.
ROCK CRUSHERS.
ROLLING MILL & TIN PLATE MILL MACHINERY

THE LLOYD BOOTH CO.
YOUNGSTOWN, O.

Manufacturers of
IRON AND STEEL WORKS MACHINERY.

THE LORAIN FOUNDRY COMPANY,

Lorain, Ohio.

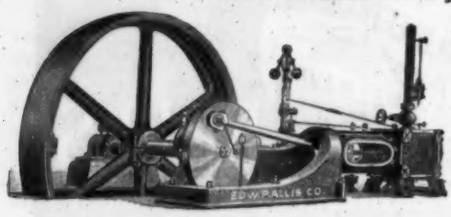
SAND AND CHILLED ROLLS.

Heavy Iron Castings in Loam, Dry and Green Sand, Made from Cupola or Air Furnace...

BRASS AND COPPER CASTINGS.

THE EDWARD P. ALLIS CO.

Milwaukee, Wis.



MANUFACTURERS OF

Blowing Engines, Hoisting Engines, Pumping Engines, Air Compressors, Special Engines for Electric Lighting, Street Railways and Rolling Mills, Ore Crushers, Crushing Rolls, Stamp Mills, Concentrators, General Mining, Milling and Smelting Machinery.

REYNOLDS CORLISS ENGINES.

NEW YORK. CHICAGO. MINNEAPOLIS. DENVER. BUTTE.
CITY OF MEXICO. SAN FRANCISCO. PITTSBURG.

Southwark Foundry & Machine Co.

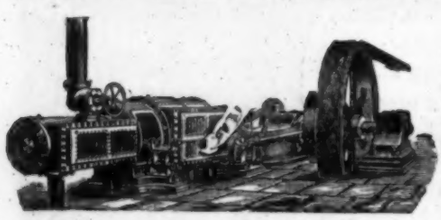
PHILADELPHIA, PA.

Porter-Allen Automatic Engines,
Blowing Engines, Centrifugal Pumps,
Weiss Counter-Current Condensers.

William Tod & Co.

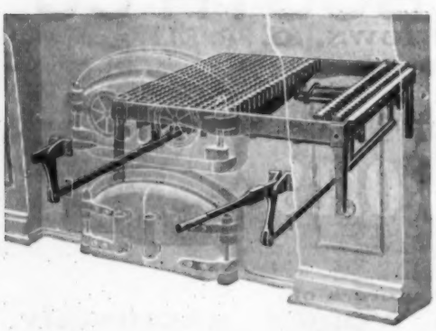
YOUNGSTOWN, OHIO.

The PORTER-HAMILTON ENGINE.



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

PARK BUILDING, PITTSBURG, - - Seward S. Babbitt.



The GEO. B. SENNETT CO.,

YOUNGSTOWN, OHIO.

Manufacturers of the

Sennett Rocking Grate

Economy of Fuel.
Economy of Time.

Prevents large clinkers. Convenient and Substantial. Apply for circulars.

We make also SENNETT ENGINE, 20 to 40 H. P., SENNETT COMPRESSION COUPLING and CASTINGS to 5 tons each.

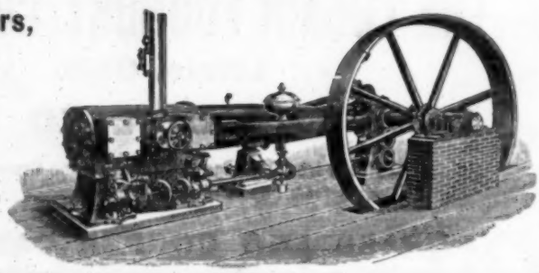
THE I. & E. GREENWALD CO.

Engineers, Founders, and Machinists.

Steam Engines, Shafting, Hangers, Pulleys, Sprocket Wheels, Chains, Etc.

Headquarters for Mill Gearing of all kinds and sizes Seam power plants complete.

720 East Pearl St.,
CINCINNATI, OHIO.



BUYERS' DIRECTORY.

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Champion Iron & Steel Co., Muskegon, Mich.

AIR COMPRESSORS—
Edw. P. Allis Co., Milwaukee, Wis.
Fraser & Chalmers, Chicago, Ill.
Rand Drill Co., Chicago, Ill.
Clayton Air Compressor Works, New York.
Ingersoll-Sergeant Drill Co., New York.
Hall Steam Pump Co., Pittsburg, Pa.
Manning, Maxwell & Moore, New York City.
W. J. Schaefer & Co., New York City.

AIR HOISTS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill
Manning, Maxwell & Moore, New York City.

AIR LIFT PUMPS—
Clayton Air Compressor Works, New York.
The Ingersoll-Sergeant Drill Co., New York.

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F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O
The Robert W. Hunt & Co., Chicago, Ill.
John T. Jones & Co., Chicago, Ill.
Cremer & Bicknell, Cleveland, O.

ANGLES—
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.

ANNEALING BOXES—
Meehan Boiler & Construction Co., Lowellville, Ohio.
Wm. B. Pollock Co., Youngstown, O.

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Theo. Hiertz & Son, St. Louis, Mo.
Magnolia Metal Co., New York City.
C. H. Besly & Co., Chicago, Ill.
Wm. Cramp & Sons, Philadelphia, Pa.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

AXLES—
Bethlehem Steel Co., So. Bethlehem, Pa.

BABBITT METAL—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
James B. Clow & Sons, Chicago, Ill.
Lorain Foundry Co., Lorain, O.
J. J. Ryan & Co., Chicago, Ill.

BALLS—
Cleveland Ball & Screw Co., Cleveland, O.

BAR IRON AND STEEL—
Monongahela Iron & Steel Co., Pittsburg, Pa.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Bourne-Fuller Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ills.
American Steel Hoop Co., Pittsburg, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
W. W. Lindsay & Co., Philadelphia, Pa.

BEARING METAL—
Magnolia Metal Co., New York City.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

BELTING—
C. H. Besly & Co., Chicago, Ill.
The Chicago Rawhide Mfg. Co., Chicago, Ill.
The Gandy Belting Co., Baltimore Md.
Main Belting Co., Philadelphia, Pa.
The Jeffrey Mfg. Co., Columbus, O.

BELT DRESSING —
The Ironsides Co., Columbus, O.

BELT LACING—
The Bristol Co., Waterbury, Conn.

BLACKSMITH AND CARRIAGE SUPPLIES—
C. H. Besly & Co., Chicago, Ill.

BLAST FURNACE WORK—
Enterprise Boiler Co., Youngstown, O.
Excelsior Iron Works Co., Cleveland, O.
Meehan Boiler & Construction Co., Lowellville, Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
The United Boiler Co., Girard, O.
West Penn Foundry&Machine Co., Avonmore, Pa

BLOWING ENGINES—
Southwark Foundry & Machine Co., Philadelphia, Pa.
Edward P. Allis Co., Milwaukee, Wis.

BOILERS AND BOILER ATTACHMENTS—
Hyde Bros. & Co., Pittsburg, Pa.
The Wm. B. Pollock Co., Youngstown, O.
Cahall Sales Department, Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
Hooven, Owens & Rentschler Co., Hamilton, O
Harrison Safety Boiler Works Philadelphia.
Meehan Boiler & ConstructionCo., Lowellville, O
Wm. Cramp & Sons, Philadelphia, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.
James Bonar & Co., Pittsburgh, Pa.
W. P. Davis Machine Co., Rochester, N. Y.
The United Boiler Co., Girard, O.
Reinhold Bettermann, Johnstown, Pa.

BOILER COVERING—
C. H. Besly & Co., Chicago, Ill.

BOILER COMPOUNDS—
The Ironsides Company, Columbus, O.

BUYERS' DIRECTORY.

BOILER FLUE PLUGS—
Reinhold Bettermann, Johnstown, Pa.

BOILER TUBES—
S. Fix Sons, Cleveland, O.
National Tube Co., Pittsburg, Pa.
Atlantic Tube Co., Pittsburg, Pa.

BOLTS AND NUTS—
Upson Nut Co., Cleveland, O.
National Elastic Nut Co., Milwaukee, Wis.

BOLT CUTTERS—
American Tool Works Co., Cincinnati, O.

BORING AND TURNING MILLS—
H. Bickford, Lakeport, N. H.
U. Baird Machinery Co., Pittsburg, Pa.
Baush & Harris Machine Tool Co., Springfield, Mass.
Bickford Drill and Tool Co., Cincinnati, O.
American Tool Works Co., Cincinnati, O.

BOX CAR UNLOADER—
The Jeffrey Mfg. Co., Columbus, O.

BRASS CASTINGS—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.

BRIDGES—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Shiffler Bridge Co., Pittsburg.

BUILDINGS (STEEL FRAME)—
Illinois Steel Co., Chicago, Ill.
Wm. B. Scaife & Sons, Pittsburg, Pa.
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.

BUCKETS AND DERRICKS—
Excelsior Iron Works Co., Cleveland, O.
J. & G. Obenberger, Milwaukee, Wis.

CABLEWAYS—
Lidgewood Mfg. Co., New York City.
Waterbury Rope Co., New York City.

CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

CAR UNLOADERS—
Excelsior Iron Works Co., Cleveland, O.

CAR WHEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

CARRYING TONGS—
Vulcan Mfg. Co., Pittsburg, Pa.

CASE HARDENING MATERIALS—
American Carburizing Co., New York City.

CASTINGS—
Seaman-Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
Macbeth & Co., Cleveland, O.
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
The Aultman Co., Canton, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Lorain Foundry Co. Lorain, O.
West Penn Foundry & Machine Co., Avonmore, Pa

CASTINGS (ALUMINUM)
J. J. Ryan & Co., Chicago, Ill.

CASTINGS (BRASS)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co Lorain, O.

CASTINGS (BRONZE)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.

CASTINGS (MALLEABLE)—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

CASTINGS (Steel)—
Hercules Steel Casting Co., Harvey, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.

CEMENT—
Garden City Sand Co., Chicago, Ill.
Reed P. Blair & Co., Pittsburg, Pa.

CHAIN BELTING—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
Buhl Malleable Co., Detroit, Mich.

CHANNELERS—
The Ingersoll-Sergeant Drill Co., New York.

CHEMISTS—
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
John T. Jones & Co., Chicago, Ill.
Cremer & Bicknell, Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
We Fu Go Co Cincinnati O
The Ideal Manufacturing Co., Buffalo N. Y.

CHILLED AND SAND ROLLS—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
The Lloyd Booth Co., Youngstown, O.
West Penn Foundry & Machine Co., Avonmore, Pa

COAL CUTTERS—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.

COAL SCREENS—
Hendrick Mfg. Co., Carbondale, Pa.
Rob't. Aitchinson Per. Metal Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

COAL AND COKE—
M. A. Hanna & Co., Cleveland, O.
Rogers, Brown & Co., Cincinnati, O
Reed P. Blair & Co., Pittsburg, Pa.
Pickand, Brown & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
McKeefrey & Co., Leetonia, O.
Pickands, Mather & Co., Cleveland, O.
J. H. Hillman & Son, Pittsburg, Pa.

COAL MINING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
Webster Camp & Lane Machine Co., Akron, O.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSED AIR SHOP TOOLS—
Clayton Air Compressor Works, New York City.
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Q & C Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
W. J. Schaefer & Co., New York City.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

CONVEYORS—
Jeffrey Mfg. Co., Columbus, O.
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
J. & G. Obenberger, Milwaukee, Wis.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.

CRANES—
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Crane & Car Co., Cleveland, O.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co., Youngstown, O.

CUTTER AND REAMING GRINDERS—
American Tool Works Co., Cincinnati, O.

DIES—
Mossberg & Granville Mfg. Co., Providence, R. I.
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, O.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa.
J. & G. Obenberger, Milwaukee, Wis.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield, Mass.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
H. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O
Buhl Malleable Co., Detroit, Mich.
Excelsior Iron Works Co., Cleveland, O.
J. & G. Obenberger, Milwaukee, Wis.

EMERY AND CORUNDUM WHEELS—
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J. Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
W. W. Lindsay & Co., Philadelphia, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.
Reinhold Bettermann, Johnstown, Pa.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co, Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co Detroit, Mich
The Ideal Manufacturing Co., Buffalo, N. Y.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas Taylor's Sons Co Cincinnati, O.
A. J. Hawes & Son, Johnstown, Pa.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLUE PLUGS—
Reinhold Bet erman, Johnstown, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Joseph Dyson & Sons, Cleveland, O.
Frankford Steel & Forging Co., Philadelphia, Pa.
J. & G. Obenberger, Milwaukee, Wis.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co Canton, O.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
Riverside Foundry Co., Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va
Excelsior Iron Works Co., Cleveland, O.

Macbeth & Co., Cleveland, O.
Vulcan Foundry & Machine Co., New Castle, Pa

FOUNDRY EQUIPMENT.
Tabor Mfg. Co., Elizabeth, N. J.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.
Maywood Foundry & Machine Co., Chicago, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co , Cleveland, O.
Thos. Furlow & Son, Philadelphia, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. P. Smith & Co., New Brighton
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co Harvey, Ill.
Cleveland Facing Mill Co., Cleveland. O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Newport Sand Bank Co., Newport, Ky
Maywood Foundry & Machine Co., Chicago, Ill.
A. J. Haws & Son, Johnstown, Pa.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAS PRODUCERS—
W. W. Lindsay & Co., Philadelphia, Pa.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co , Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Nazel & Bassett, Philadelphia, Pa.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
O & C Co., Chicago, Ill.
Cleveland Punch & Shear Wks. Co., Cleveland, O

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
Wefugo Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.
The United Boiler Co., Girard, O.
The Ideal Manufacturing Co., Buffalo, N. Y.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.
J. & G. Obenberger, Milwaukee, Wis.

HOISTING MACHINERY—
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
J. & G. Obenberger, Milwaukee, Wis.

HOLLOW SHAFTING—
Atlantic Tube Co., Pittsburg, Pa.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
H. H. Stroud & Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna Standard Iron & Steel Co., Bridgeport, O.
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co , Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co ,Cleveland,O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
American Machinery & Trading Co., N. Y. City.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co , Youngstown, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
Hyde Bros. & Co., Pittsburg, Pa.

LUBRICANTS—
The Ironsides Co., Columbus, O.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
American Machinery & Trading Co., N. Y. City.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Nazel & Bassett, Philadelphia, Pa.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANILLA ROPE COATING—
The Ironsides Co., Columbus, O.

MANUFACTURING CHEMISTS—
The Ideal Manufacturing Co., Buffalo, N. Y.
Wefugo Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Champion Iron & Steel Co., Muskegon, Mich.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Cabeen Co., Philadelphia, P
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co , Cleveland, O.

MILL CASTINGS—
Schuykill Iron & Steel Co., Philadelphia, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis,
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co , New Yotk City.
Exeter Machine Works, Pittson, Pa
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.
Wm. B. Pollock Co., Youngstown, O.
J. & G. Obenberger, Milwaukee, Wis.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.
Thos. Furlow & Son, Philadelphia, Pa.
Maywood Foundry & Machine Co., Chicago, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill

NUTS (Self-Locking)—
National Elastic Nut Co., Milwaukee, Wis.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.
National Elastic Nut Co., Milwaukee, Wis.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
Rockwell Engineering Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
American Tool Works Co., Cincinnati, O.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Hendrick Mfg. Co., Carbondale, Pa.

ORE TESTING MACHINERY—
Kevstone Driller Co., Beaver Falls, Pa

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
The Ironsides Co., Columbus, O.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Cabeen Co., Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O
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Pickands, Brown & Co., Chicago, Ill.
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Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
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J. H. Hillman & Son, Pittsburg, Pa.

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
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PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

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Bethlehem Steel Co., So. Bethlehem, Pa.

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Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

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Republic Iron & Steel Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.
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James B. Clow & Sons, Chicago, Ill.

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Clayton Air Compressor Works, New York.
Q & C Co., Chicago, Ill.
W. J. Schaefer & Co., New York City.

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C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

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Mossberg & Granville Mfg. Co., Providence, R.I.
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E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

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Avery Stamping Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Cleveland Punch & Shear Wks. Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
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The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co. Milwaukee, Wis
Blakeslee Mfg. Co. Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass
American Tool Works Co., Cincinnati, O.

RAILS—
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.

RAW HIDE GEARS—
Nasel & Bassett, Philadelphia, Pa.

RELAYING RAILS—
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd. Pittsburg, Pa.
Youngstown Rivet Co., Youngstown, O.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa.

ROLLER BEARINGS—
Mossberg & Granville Mfg. Co., Providence, R.I.

ROLLING MILLS—
Mossberg & Granville Mfg. Co., Providence, R.I.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.
The Lloyd Booth Co., Youngstown, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
West Penn Foundry & Macaine Ca., Avonmore, Pa.

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

ROPE AND CORDAGE—
Waterbury Rope Co., New York City.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt. Aitchison Perforated Metal Co., Chicago
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.

SECOND-HAND MACHINERY—
Hyde Bros & Co., Pittsburg, Pa.
Torbert & Peckham, Chicago, Ill.
American Machinery & Trading Co., N. Y. City.

SENSITIVE DRILLS—
American Tool Works Co., Cincinnati, O.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
James Bonar & Co., Pittsburg, Pa.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.

SHAPE IRON AND STEEL—
W. W. Lindsay & Co., Philadelphia, Pa.

SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago Ill.
Republic Iron & Steel Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPECIAL MACHINERY—
Cleveland Punch & Shear Wks. Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
Avery Stamping Co., Cleveland, O.
Mossberg & Granville Mfg. Co., Providence, R.I.
Q & C Co., Chicago, Ill
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co. Cleveland, O.
Nasel & Bassett, Philadelphia, Pa.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co., Chicago Ill

STEAM PACKING—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Hall Steam Pump Co., Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa

STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co., Marion, O
The Bucyrus Co., South Milwaukee, Wis.

STEAM SPECIALTIES—
C. H. Besly & Co. Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

STEEL—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Braeburn Steel Co., Braeburn, Pa.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

STEEL BALLS—
Cleveland Ball & Screw Co., Cleveland, O.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel & Wire Co., Chicago, Ill.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich.
National Steel Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
Hercules Steel Casting Co., Harvey, Ill.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

STEEL TUBING—
Atlantic Tube Co., Buffalo, N. Y.

STRUCTURAL IRON WORK—
W. W. Lindsay & Co., Philedelphia, Pa.

TANKS—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowell ville O
Wm. B. Scaife & Sons, Pittsburg, Pa.
The Wm B Pollock Co Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
The United Boiler Co., Girard, O.

TANK CARS—
The Wm. B. Pollock Co., Youngstown, O.

TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

TIN AND TERNE PLATES—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, New York City,

TIN PLATE MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry & Machine Co., Avonmore, Pa

TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

TRAMWAY EQUIPMENT—
Whiting Foundry Equipment Co., Harvey, Ill.

TRANSMISSION MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
W. A. Jones Foundry & Machine Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

TROLLEY TRACKS—
Whiting Foundry Equipment Co., Harvey, Ill.
Northern Engineering Works, Detroit, Mich.

TRUCKS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TUBES—
National Tube Co., Pittsburg, Pa.
S. Fix' Sons, Cleveland, O.
Atlantic Tube Co., Buffalo, N. Y.

TUBE WELDING—
S. Fix Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TURNBUCKLES—
Republic Iron & Steel Co., Chicago, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.

TWIST DRILLS—
C. H. Besly & Co., Chicago. Ill.

TWIST DRILL CASES—
Vulcan Mfg. Co., Pittsburg, Pa.

VALVES—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

WASHERS—
Avery Stamping Co., Cleveland, O.

WATER SOFTENING PLANTS—
Wefugo Co., Cincinnati, O.
The Ideal Manufacturing Co., Buffalo, N. Y.

WELDLESS TUBES—
Atlantic Tube Co., Buffalo N. Y.

WIRE—
American Steel & Wire Co., Chicago, Ill.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Company, Columbus, O.

WIRE MACHINERY—
S. W. Goodyear, Waterbury, Conn.
Mossberg & Granville Mfg. Co., Providence, R.I.

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE—
Waterbury Pope Co., New York City.

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.

WIRE ROPE FILLING—
The Ironsides Company, Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.

WROUGHT PIPE—
National Tube Co., Pittsburg, Pa.

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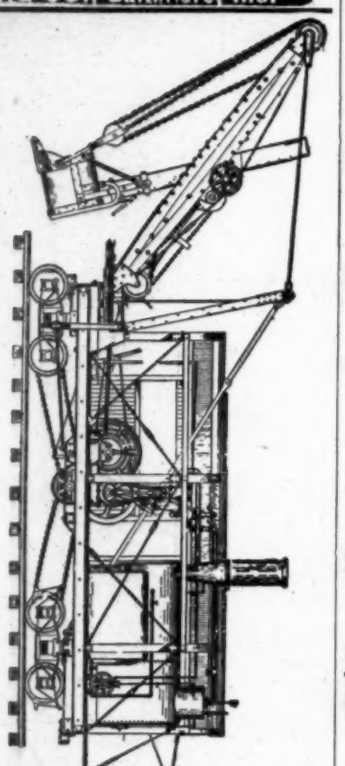

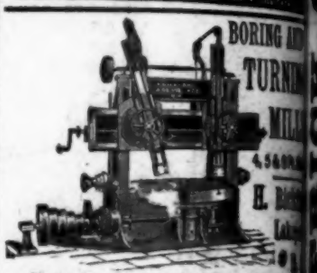

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